EAL CONSULT BUILDING SUSTAINABILITY SINCE 2008

ENERGY & SUSTAINABILITY ASSESSMENT

13 BEDFORD ROAD

PROPERTY ADDRESS

13 BEDFORD RD
WOOD GREEN
LONDON
N22 7AU

DATE

Rev.1 October 2024

PREPARED BY

EAL Consult

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1. EXECUTIVE SUMMARY

Site description

This Energy and Sustainability Assessment has been prepared to support the planning application for the erection of 12 new build flats in Wood Green, with a gross internal residential floor area of 808m^2 and a non-residential floor area of 258m^2.

Strategy

The strategy highlights how the proposed development will promote sustainability throught both design and operation and responds to the UK Planning and regulatory framework, National Planning Policy Framework 2023, the London Plan 2021, Haringey's Local Plan Strategic Policies and Development Management DPD, summarising how the relevant targets will be addressed and achieved.

Energy Hierarchy

In accordance with the Energy Hierarchy detailed within The London Plan 2021, this statement outlines an overall commitment to reducing energy consumption under occupancy through the adoption of a 'Fabric First' principle, which will seek to enhance insulation standards and improved heating and lighting efficiencies in comparison to the standard requirements of Approved Document Part L 2021. The viability of district heating will be explored. Further carbon emission reduction will be achieved by using renewable technologies.

- ***Be 'Lean':*** Passive design principles including a high level of insulation and reduced air permeabilty to deliver Part L compliant Building in absence of renewable technologies. It will achieve **24%** reduction in carbon emissions over Part L 2021 baseline.
- ***Be 'Clean':*** district heating was deemed not viable for this project
- ***Be 'Green':*** Air Source Heat Pumps and Photovoltaic panels have been proposed for the specific scheme and will deliver a further **57%** reduction in regulated carbon emissions over Part L 2021 baseline

Energy Effcicency & Carbon Reduction

- This report demonstrates that the proposed development by incorporating the measures above can achieve an **overall** carbon emission reduction of **82%**
- To combat the shortfall in reduction, the following carbon offset is suggested:
  - **£6,288**

Overheating

Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the cooling hierarchy. This project reaches the passive ventilation stage of the following cooling hierarchy:

1) Reduce the amount of the heat entering a building in summer
2) Minimise internal heat generation
3) Manage the heat within the building
4) Passive ventilation
5) Mechanical ventilation
6) Provide active cooling systems.

Sustainability

Sustainable Design:

- Natural lighting is incorporated to prevent excessive demand for artificial lighting
- The development will not increase the air pollution of the area
- Total internal water consumption will not exceed 105 litres/person/day
- All contractors should sign up to the nationally recognised Considerate Constructors Scheme
- Designated space for waste and recycling facilities
- Low Flood Risk area

Urban Greening

- Urban Greening Factor (UGF) of 0.4 proposed

Reducing Waste and Supporting the Circular Economy:

- Minimising the use of virgin materials during construction by recycling and reusing where feasible.
- Promote a more circular economy that improves resource efficiency and innovation to keep products and materials at their highest use for as long as possible
- Encourage waste minimisation and waste prevention through the reuse of materials and using fewer resources in the production and distribution of products
- Low waste benchmark levels will be targeted during construction with requirements identifying that the diversion of waste from landfill is to be achieved by the contractor.
- Site specific material details are highlighted in Section 5e.

2. METHODOLOGY

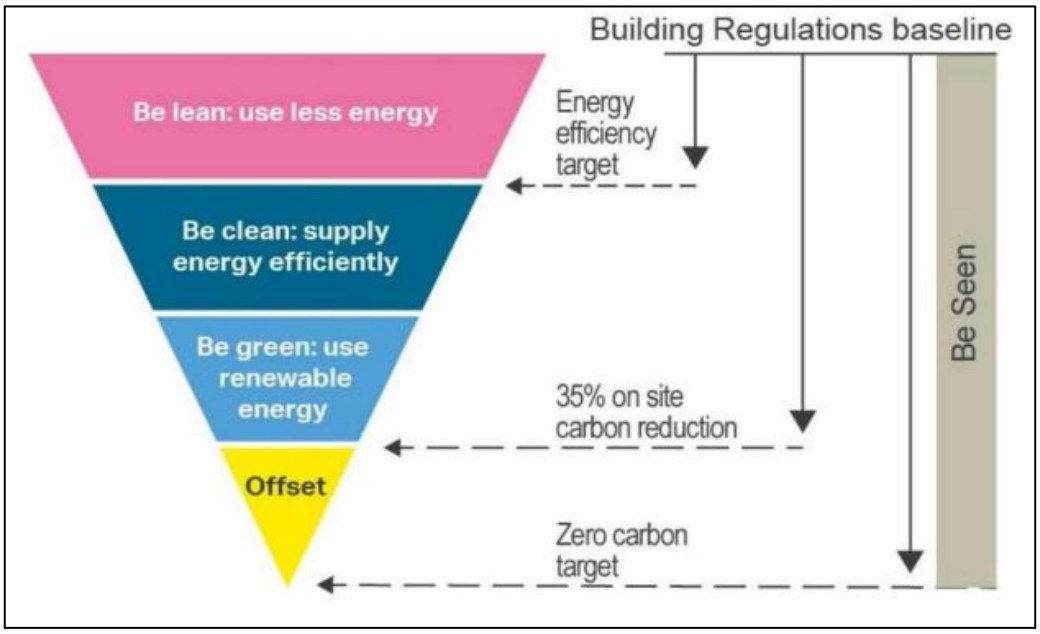
This energy assessment outlines the energy demand from the development together with the associated CO_2 emissions, using Building Regulations Part L 2021

as a baseline. It demonstrates how the emissions from energy use in the development will be reduced through energy efficiency measures.

The proposed scheme is required to achieve carbon emission reduction principles in accordance with the UK Planning and regulatory framework.

The methodology employed to determine the potential CO_2 savings is in accordance with the three-step Energy Hierarchy.

Figure 1: The London Plan Energy Hierarchy



- ***Be 'Lean'*** **-** Improve the energy efficiency of the scheme;
- ***Be 'Clean'*** **-** Supply as much of the remaining energy requirement with low carbon; technologies such as district heating if available or combined heat and power (CHP); and
- ***Be 'Green'*** **-** Offset a proportion of the remaining carbon dioxide emissions by using renewable technologies.
- ***Be 'Seen'*** - monitor, verify and report on post-construction energy performance

The government approved Standard Assessment Procedure (SAP) methodology (2021) and Simplified Building Energy Model (SBEM) software has been used to determine the CO_2 emissions and energy requirements. It compares CO_2 emissions from regulated energy use (DER and BER) with those of an equivalent dwelling/building built to Part L 2021 (TER), a notional dwelling/building of the same size and shape.

Opportunities for incorporating features into the development that contribute to the objectives of sustainable development were explored during the design process, to ensure that where possible, the proposals achieve best practice.

3. PLANNING POLICY CONTEXT

National Planning Policy Framework (NPPF) 2023

Emphasised the concept of sustainable development by encouraging local authorities to adopt proactive strategies to mitigate and adapt to climate change. It recommends the move to a low carbon future by:

- Avoiding increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
- Contributing to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.
- To help increase the use and supply of renewable and low carbon energy and heat, plans should:
    - provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
    - consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
    - identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for colocating potential heat customers and suppliers.
- New updates emphasised that when determining planning applications, local planning authorities should give significant weight to the need to support energy efficiency and low carbon heating improvements to existing buildings, both domestic and non-domestic.

The London Plan 2021

Policy SI 2 Minimising Greenhouse Gas Emissions:

A. Major development should be net zero-carbon. Proposals should make the fullest contribution to reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy: i) Be lean: use less energy and manage demand during operation, ii) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly, iii) Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site, iiii) Be seen: monitor, verify and report on energy performance

B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either: i) through a cash in lieu contribution to the borough's carbon offset fund, or i) off-site provided that an alternative proposal is identified, and delivery is certain.

D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.

Policy 5.3 Sustainable Design and Construction

Major development proposals should meet minimum standards outlines in the supplementary guidance Sustainable Design and Construction SPG (2014), to consider the following principles:

a. Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
b. Avoiding internal overheating and contributing to the urban heat island effect
c. Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
d. Minimising pollution (including noise, air and urban runoff)
e. Minimising the generation of waste and maximising reuse or recycling
f. Avoiding impacts from natural hazards (including flooding)
g. Ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
h. Securing sustainable procurement of materials, using local supplies where feasible, and
i. Promoting and protecting biodiversity and green infrastructure.

Haringey's Local Plan Strategic Policies 2013 – 2026

Policy SP4: Working towards a Low Carbon Haringey

Over the life time of the Local Plan, reducing energy use in buildings and working towards a low carbon borough will be one of the key challenges facing Haringey. The Council will promote the measures outlined below to reduce carbon emissions from new and existing buildings.

1. In line with London Plan policy, the Council will promote and require all new developments to take measures to reduce energy use and carbon emissions during design, construction and occupation, by incorporating the following measures:
    a. From 2011 onwards, all new residential development will achieve a minimum 25% reduction in total (regulated) CO2 emissions in line with Code for Sustainable Homes Level 4 energy standards, and should aim to achieve Level 6. All new residential development shall be zero carbon from 2016 onwards; and
    b. From 2011 onwards all new non-residential development shall be built to at least BREEAM "very good" standard and should aim to achieve BREEAM "excellent" or the current nationally agreed standard. All new non-residential development shall be zero carbon from 2019.
2. The Council will promote low- and zero-carbon energy generation through the following measures:
    a. Requiring all developments to assess, identify and implement, where viable, site-wide and area-wide decentralised energy facilities including the potential to link into a wider network;
    b. Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible;
    c. Working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks including the potential in the Upper Lee Valley Opportunity Area; and

d. All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from on site renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.

Development Management DPD 2017

Policy DM19: Nature Conservation

A. Development proposals on sites which are, or are adjacent to, internationally designated sites, Sites of Special Scientific Interest, Local Nature Reserves, Sites of Importance for Nature Conservation or Ecological Corridors, should protect and enhance the nature conservation value of the site.
B. Development that has a direct or indirect adverse impact upon important ecological assets, either individually or in combination with other development, will only be permitted where: a The harm cannot be reasonably avoided; and b It has been suitably demonstrated that appropriate mitigation can address the harm caused.

4. ENERGY STRATEGY

The Energy strategy for the proposed development is based on the Building Regulations Part L; it adopts a set of principles to guide design and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. It seeks to incorporate energy efficiency through the approach detailed below.

The following tables and graph demonstrate the carbon emissions and savings.

Table 1. Residential CO_2 Emissions from each stage of the Energy Hierarchy

	Emissions (Tonnes CO_2 per annum)
	Regulated
Part L 2021 Baseline	10.7
Be Lean: Savings from Energy Demand Reduction	7.9
Be Clean: Savings from Heat Network	7.9
Be Green: Savings from Renewable Energy	1.5

Table 2. Non-residential CO_2 Emissions from each stage of the Energy Hierarchy

	Emissions (Tonnes CO_2 per annum)
	Regulated
Part L 2021 Baseline	1.3
Be Lean: Savings from Energy Demand Reduction	1.1
Be Clean: Savings from Heat Network	1.1
Be Green: Savings from Renewable Energy	0.7

Table 3. Sitewide Carbon Dioxide Emissions and Savings from each stage of the Energy Hierarchy

	Regulated Carbon dioxide (Tonnes CO_2 per annum)		
	Emissions	Savings	%
Part L 2021 Baseline	12.0		
Be Lean: Savings from Energy Demand Reduction	9.0	2.9	24
Be Clean: Savings from Heat Network	9.0	0	0
Be Green: Savings from Renewable Energy	2.2	6.8	57
Cumulative on-site savings		9.8	82
Annual Savings from off-set payment		2.2	
(tonnes CO_2)			
Cumulative Savings for offset payment		66.2	
Cash-in-lieu contribution		6,288	

a. Baseline Model

In accordance with London Plan Policy SI 2, a baseline model is run with Building Regulations Part L target values as set out in SAP 10.2 Appendix R and the National Calculation Methodology Modelling Guide. Any energy generating technologies that are to be included at Be 'Green' stage are also included in the baseline model. This model is then used in the Energy Strategy process in comparison to the Be 'Lean', Be 'Clean' and Be 'Green' scenarios of the Energy Hierarchy, to establish the regulated CO2 emissions from the development.

The baseline model used for this project assumed that any residential heating and hot water supply would be provided by a gas boiler and any active cooling would be provided by electrically powered equipment. The baseline commercial model uses notional efficiency figures. The comparative Be 'Lean' model assumes the same heating strategy.

The assumed U-values of the baseline model are seen in the table below:

Table 4. Part L Building Regulations Notional U-values (residential)

Thermal element	Part L 2021 Notional Specification	Baseline Model
Walls	0.18 W/m^{2}k	0.18 W/m^{2}k
Roof	0.11 W/m^{2}k	0.11 W/m^{2}k
Windows & Doors	1.2 W/m^{2}k	1.2 W/m^{2}k

b. Be 'Lean' - Demand Reduction

In accordance with London Plan Policy SI 2 the development must achieve at least a 10% improvement in energy efficiency on Building Regulations Part L 2021 baseline scenario.

The building fabric performance and engineering systems have been optimised in order to use less energy prior to the inclusion or consideration of Low and Zero Carbon (LZC) Technology.

Through passive design measures, efficient building fabric and engineering systems the building is estimated to achieve **24%** reduction in annual regulated CO_2 emissions over Part L benchmark, therefore demonstrating compliance with Building Regulations Through passive means alone without the utilisation of renewable technologies.

Passive Design Measures

Fabric Performance - The fabric performance values aim to reduce unwanted heat loss and heat gains, whilst maintaining a comfortable internal environment.

The heat loss of different building elements is dependent upon their U –value. A building with low U values provides better levels of insulation and reduced heating demand.

The development will incorporate high levels of insulation and efficient glazing; thereby reduce demand for space heating. The table below shows the U values for the development and the associated improvements over Building Regulations.

Table 5. Residential Energy Efficient Design Specification

Element	Building Regulations 2021 Standard	Specification
Walls	0.26 W/m²k	0.15 W/m²k
Roof	0.16 W/ m²k	0.11 W/m²k
Floors	0.18 W/m²k	0.18 W/m²k
Windows and Doors	1.6 W/ m²k	0.8 W/m²k

Table 6. Commercial Energy Efficient Design Specification

Element	Building Regulations 2021 Standard	Specification
Walls	0.26 W/m²k	0.15 W/m²k
Roof	0.18 W/ m²k	0.11 W/ m²k
Ground Floor	0.18 W/m²k	0.13 W/m²k
Windows, Doors and Shopfront	1.6 W/ m²k	0.8 W/m²k

Table 7. Development Part L Fabric Energy Efficiency Standard (FEES)

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement %
Development Total	33.42	28.12	16

Thermal Bridging - Thermal bridging will be reduced. The thermal bridging calculations achieve an average y-value of 0.140 aligning with enhanced construction detail and cold bridges will be avoided.

Air Permeability – designed to achieve an air permeability score of 3 in the residential units and 5 for the commercial units

Thermal Mass - The average thermal mass is 188.6 kJ/m2K. The brick outer leaf contributes to high thermal mass and leads to the effective storing of heat during the day and convective cooling at night. The high thermal mass allows for high diurnal swing to be effective in passive cooling and heating strategy.

Efficient Lighting and Controls - Throughout the development natural lighting will be optimised. The development will also incorporate low energy light fittings throughout. All light fittings will be specified as low energy lighting and will accommodate LED luminaries only.

Ventilation - The use of mechanical ventilation with heat recovery is proposed for the dwellings due to high levels of noise along Bedford Road. The commercial units will make use of natural ventilation due to the small size of the units.

Space Heating & Cooling - Space heating for the residential units is provided ASHPs which will provide 100% of demand, supported by solar photovoltaic panels (PV). Space heating for the commercial units will be provided by a combined heating and cooling system.

Hot Water system – Residential hot water is supplied for the dwellings via a built in cylinder. Non-residential hot water will be supplied via instantaneous hot water.

Waste Water Heat Recovery (WWHR) has been included.

Energy Use Intensity and Space Heating Demand

Table 8. Energy Use Intensity (EUI) and Space Heating Demand

Building type	EUI	Space heating demand	EUI value from Table 4 of the guidance	Space heating demand from Table 4 of the guidance	Methodology used
	excluding renewable energy (kWh/m^2/year)				
Residential	103.05	9.21	35	15	Part L1 SAP
Non-residential	182.75	21.61	55	15	Part L2 SBEM

c. Be 'Clean' - Supply Energy Efficiently

The Be Clean step of the energy hierarchy refers to the use of 'Clean energy supply'. This includes, but is not limited to, the use of Combined Heat and Power (CHP) and District Heat Networks. Policy SI 3 seeks for new development to promote the use of CHP and district heating.

Policy SI 1 Improving Air Quality

A. Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B. To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1. Development proposals should not:
    a. lead to further deterioration of existing poor air quality
    b. create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits
    c. create unacceptable risk of high levels of exposure to poor air quality.
2. In order to meet the requirements in Part 1, as a minimum:
    a. development proposals must be at least Air Quality Neutral
    b. development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures
    c. major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1
    d. development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

E. Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.

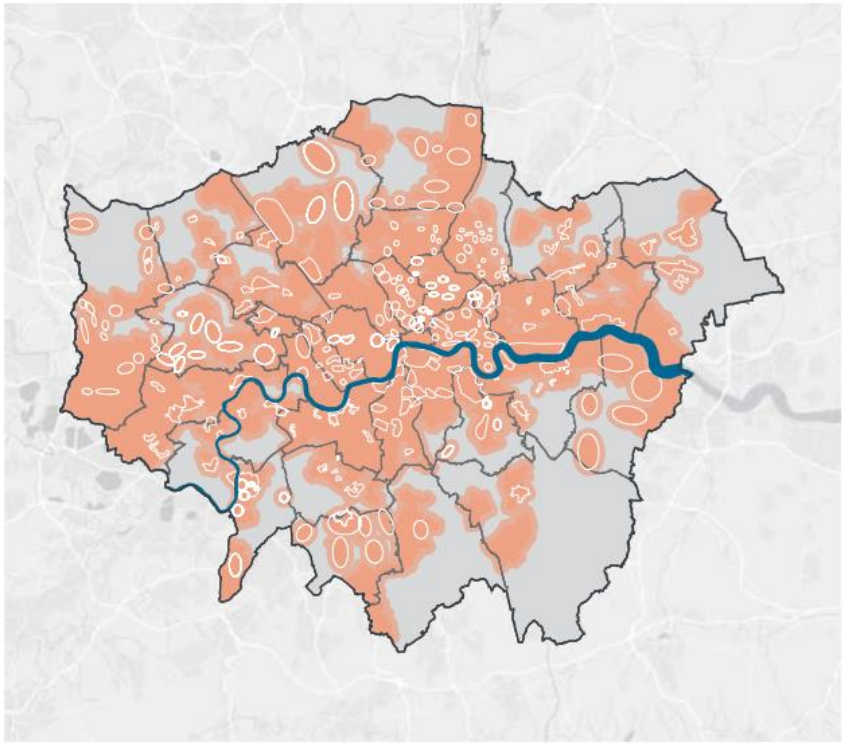
Policy SI 3 Energy Infrastructure

A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

C. Development Plans should:

1. identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure
2. identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.

Figure 2 – Heat Network Priority Areas



District Heating and Cooling

The site does not fall into an opportunity area with decentralised energy potential as identified in the London Plan or Local Plan.

Community heating and Combined Heat and Power (CHP system)

CHP systems are usually needed where there is a large heat demand (schemes with more than 100-150 dwellings), usually resulting from the building(s) being in continuous use, or through specific heating requirements such as a swimming pool. Community (or district) heating involves using a central boiler plant (or other heat sources) to heat a number of buildings through a network of well-insulated underground pipes. This system is not considered appropriate for this development

In light of the small scale of the proposed development, it is apparent that the use of CHP is also technically and financially unviable in this instance.

Site-wide communal system/network and design for district network connection

In light of the small scale of the proposed development and it is location; it is apparent that the use a heatpump fed site-wide network is technically and financially unviable.

Air Quality

In line with London Plan Policy SI 1 all developments are required to demonstrate compliance with the Building Emission Benchmarks (BEB) set out in the Air Quality Neutral LPG. The BEB demonstrates the emissions from equipment used to supply heat and energy to the buildings.

As the heating system proposed for this development is a heat pump, in accordance with the Air Quality Neutral LPG it is assumed that this project meets BEB and a full Air Quality Neutral (AQN) Assessment is not required.

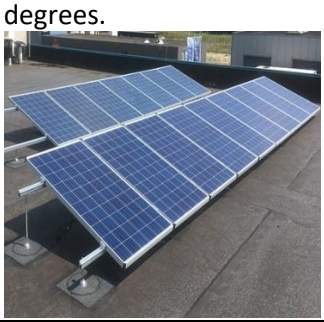
d. Be 'Green' - Renewable Energy

In accordance with London Plan Policy SI 2 and Local Plan Policy SP4 all new development must achieve a minimum 20% reduction from on-site renewable energy generation.

Once energy demand reduction measures have been applied, methods for generating low and zero carbon energy can be assessed. The following renewable technologies can be considered for the project: Biomass, Water source heat pump, air source heat pump, Wind energy and solar photovoltaic panels.

Table 9. Renewable Technologies Feasibility Table

Technology	Pros	Cons
Biomass Heating A biomass system designed for wood pellets, which have a high-energy content, would fuel this development. 	• Less volume of storage • Less maintenance and produce considerably less ash residue	• Nox Emissions which may impacts • High Costs • Not suitable for the project

Ground Source Heat Pump It circulates a mixture of water and antifreeze around a loop of pipe, called a ground loop, which is buried in the garden. Heat from the ground is absorbed into the fluid and passes through a heat exchanger into the heat pump 	• Use all through the year	• High Costs • Not suitable for this project
Air Source Heat Pump They are an efficient and environmentally-friendly way of heating using air drawn freely from the atmosphere. They operate rather like a refrigerator in reverse, absorbing heat from the air into a working fluid which is passed into a compressor where its temperature is increased before it is transferred into the heating and hot water circuits of the building	• Can generate less CO_2 than conventional heating systems. • Cheaper • Provides heating and hot water • Less maintenance • Can be used as air-conditioning in the summer	• Needs electricity • Can be noisy
Wind Turbines Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings. 	• Cheaper • Less CO_2	• Local wind speeds in the area is likely to be below the level generally required for investment in large wind turbines. • Noise and signal interference. • Detrimental aesthetic impact
Solar Photovoltaic Panels (PV) Photovoltaic panels extract the energy of the sun to generate electricity. They operate most efficiently when oriented to the south and are inclined to about 35 degrees. 	• Cheaper • Less CO_2 • No input power in order to generate electricity.	

Renewable Technologies Feasibility Review Conclusion

The renewable energy sources that have been reviewed for this project are Biomass Heating, Ground Source Heat Pump, Air Source Heat Pump, Domestic Wind Turbine and Solar Photovoltaic Panels (PV).

On review of the above technologies, it has been concluded that the use of air source heat pumps and photovoltaic panels are to be incorporated in the design because together they achieve a CO_2 percentage reduction of **54%** contributing to an overall reduction of **82%** in carbon emissions. The residential units will have a 9.16 kWp array and each commercial unit will have a 2kWp array, ensuring that every unit benefits independently from energy generation.

Table 10. Residential Photovoltaic Panels

System size	Pitch	Degree	Orientation
9.16 kWp	Horizontal	15	South facing

Table 11. Non-Residential Photovoltaic Panels (per unit)

System size	Pitch	Degree	Orientation
2 kWp	Horizontal	15	South facing

Table 12. Residential ASHP Specification

Seasonal Coefficient of Performance (SCOP) (W/W)		Seasonal Energy Efficiency Ratio (SEER) (W/W)	
Water at 35	Water at 55	Water at 7	Water at 18
4.95	3.52	5.34	8.21

Table 13. Non-residential ASHP Specification

EER	COP	SEER
3.5	3.5	6.5

A 11.16kWp array is estimated to require 55.8 m² of roof space. As the total available roof area is 165 m² there is plenty of roof space available for plant equipment and/or other requirements.

e. Be 'Seen' - Monitoring Performance

In accordance with London Plan Policy Guidance 'Be Seen' Energy Monitoring 1.2, the following is suggested:

1.2.1 To truly achieve net zero-carbon buildings we need to have a better understanding of their actual operational energy performance. Although Part L calculations and Energy Performance Certificates (EPCs) give an indication of the theoretical performance of buildings, it is well established that there is a 'performance gap' between design theory and measured reality.

1.2.2 To address this gap the London Plan Policy SI 2 'Minimising greenhouse gas emissions' introduces a fourth stage to the energy hierarchy; the 'be seen' stage, which requires monitoring and reporting of the actual operational energy performance of major developments for at least five years via the Mayor's 'be seen' monitoring portal.

1.2.3 The 'be seen' policy establishes post-construction monitoring as good practice, enabling developers and building owners to better understand their buildings and identify methods for improving energy performance from the project inception stage and throughout the building's lifetime.

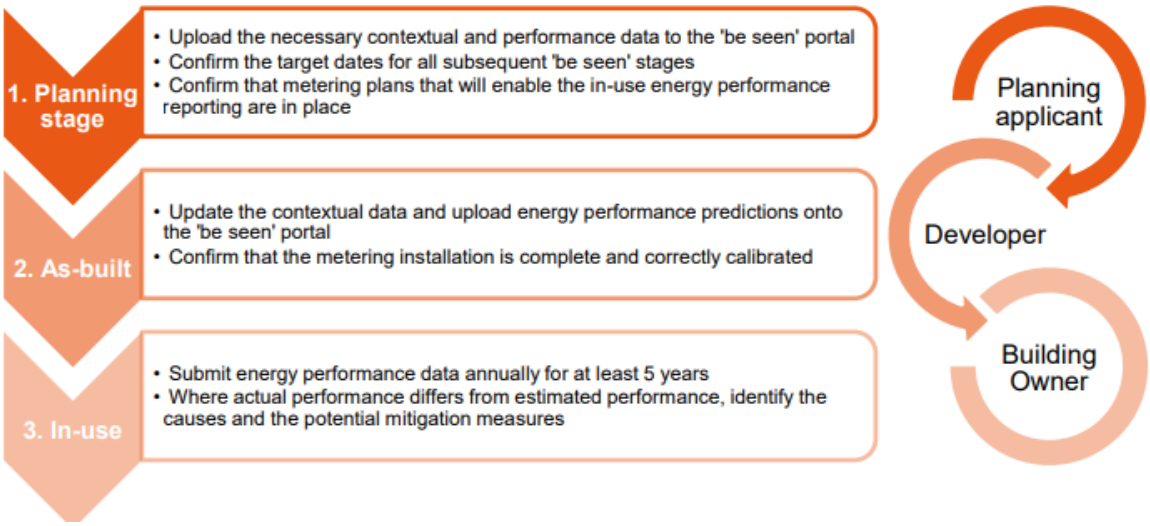
1.2.4 Ensuring that the actual energy and carbon performance of buildings is aligned with the estimated energy and carbon performance will also be a key factor in achieving a zero-carbon London.

1.2.5 The energy performance data that will be collected will provide an evidence base which could help inform future industry-wide benchmarks or performance ratings for major building typologies based on in-use performance

1.2.6 An effectively implemented post-construction monitoring regime can have a number of benefits including environmental (for example, carbon emissions reduction) and socio-economic (for example, reduced occupants' bills, raised awareness around energy usage).

Figure 3 outlines the 'be seen' process through the reporting stages of a development

Figure 3. 'Be seen' process and responsibilities



Both residential and non-residential units will be installed with their own sub-meter and smart metering equipment, with display of energy usage and generation to raise awareness of occupants. This can help occupants to reduce demand and subsequent running costs. The GLA spreadsheet informs the planning stage energy performance data including carbon offset. An on-site operational manual will be provided for the occupants on completion of the build to assist residents better understanding of appliances and cost management.

5. SUSTAINABILITY STRATEGY

a. Sustainable Design

London Plan Policy 5.3 Sustainable Design and Construction and Sustainable Design and Construction SPG (2014) to consider the following principles:

a. Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
b. Avoiding internal overheating and contributing to the urban heat island effect

c. Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
d. Minimising pollution (including noise, air and urban runoff)
e. Minimising the generation of waste and maximising reuse or recycling
f. Avoiding impacts from natural hazards (including flooding)
g. Ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
h. Securing sustainable procurement of materials, using local supplies where feasible, and
i. Promoting and protecting biodiversity and green infrastructure.

The proposed project incorporates sustainable design and construction measures capable of mitigating and adapting to climate change to meet future needs. This section details site-specific initiatives which demonstrate how the conversion helps to meet the sustainability objectives set out in the National Planning Framework 2023.

Materials Efficiency

Materials can have a significant impact on environmental performance, both in construction but also ongoing use. Materials used for the building will have lower environmental impacts over their lifecycle. This applies to the materials used in the external walls, roof and glazing. This extends to elements of the materials category such as the basic building materials (internal walls) and the finishing elements (fascia, skirting, and furniture).

b. Overheating Strategy

Policy SI 4 Managing Heat Risk

A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

Minimise Heat Generation Through Energy Efficient Design

Through the use of passive and active design measures, the design team have enabled the development to require less energy through the use of optimised insulation, cross ventilation, improved window u-values, higher air tightness, reduced cold bridging, green roof & wall elements and light coloured materials.

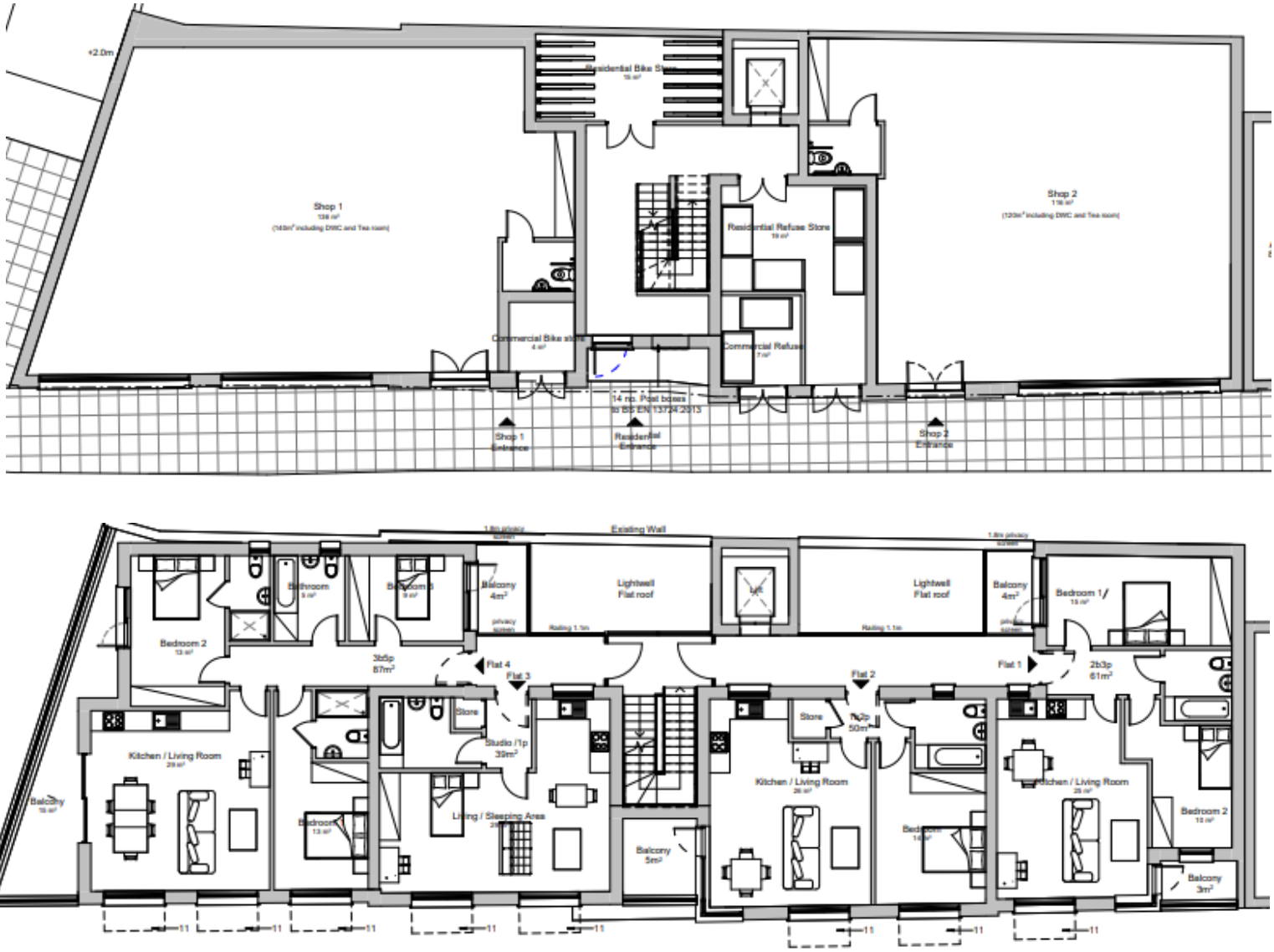
Table 13. Thermal Elements Performance

Element	
Solar Shading	External and Internal shading
Ventilation	Passive and MVHR
Wall	0.15 W/m²k
Roof	0.11 W/m²k
Ground Floor	0.13 W/m²k
Windows and Doors	U-value: 0.8 W/m²k G-value: 0.5 W/m²k
Air Permeability	Residential: 3 Commercial: 5

Daylight

The design of the development has taken into consideration day lighting to habitable spaces to improve the wellbeing of occupants. Good levels of daylight will offer occupants a pleasant and highly valued connection to the outdoors and plenty of natural light. It will also reduce the use of artificial lighting and therefore energy use. All light fittings will be specified as low energy lighting.
No external lighting is required. The location and orientation of windows help to create a design that avoids overheating in the summer

Figure 4. Internal layout of Ground Floor (commercial) and First Floor (residential)



c. Water Efficiency

Water: Water Efficiency
In domestic and non-domestic buildings, the demand for water can be reduced as much as 50% using a variety of simple and innovative strategies that are integrated into the plumbing and mechanical systems. In order to reduce water consumption the proposed development will include efficient fixtures with low flow rates. Total internal water consumption will not exceed 105 litres/person/day.

Table 14. Water Fittings Standards

Schedule Appliance Water Consumption		
Appliance	**Flow rate or Capacity**	**Total Litres**
WC	Dual flush WC 4/2.6 litre	14.72
Basin	1.7 litres/min	5.98
Shower	8 litres/minute flow	24.00
Bath	160 litres	25.60
Sink	4 litres/min	14.13
W/machine	Default used	16.66
Dish Washer	Default used	3.90
		104.99

d. Pollution: Light, Air and Noise

Light

Light pollution can best be described as artificial light that is allowed to illuminate or intrude upon areas not intended to be lit. Light in the wrong place at the wrong time can be intrusive.
Intrusive light is over bright or poorly directed lights shining onto neighbouring property which affect the neighbours' right to enjoy their property. Therefore, the proposal will incorporate lighting measures in order to avoid causing a nuisance.

Air and Noise

The layout of the development can provide good internal air quality for habitable areas but not too much so as to waste heat.

The use of openable windows will create horizontal airflow. By achieving a good naturally ventilated building the energy demand for air conditioning and mechanical ventilation will thereby be eliminated within the development.

The development will not increase the air pollution of the area by reducing as a start, its energy use, which in turn will reduce emissions that lead to air pollution.
Other measures will include:

a. Use of eco-friendly building materials
b. Non-toxic paints
c. Installation of energy efficient appliances and devices
d. Use of renewable technologies

e. Waste Management

Considerate Construction

All contractors would be required to sign up to the nationally recognised Considerate Constructors Scheme which requires, amongst other things that dust emissions, potential noise pollution, impacts on water quality and the potential for ground contamination are minimised during demolition and construction. The Contractor would also be obliged to adhere to a site-specific Code of Construction Practice to reduce potential nuisance effects.

Diversion of waste from landfill

- Where possible, segregation of recyclable and non-recyclable material will be employed for all waste generated throughout the construction process. Furthermore, material will be re-used on-site where feasible;
- Pre-fabrication of materials/elements such as bathroom pods, pipework and riser materials will be considered;
- Reusable packing solutions with key product manufacturers will be explored at the earliest opportunity. Solutions may include flat pallets, bulk bags, steel stillages and returnable cable drums;
- Construction waste – minimum 80% diversion from landfill rate;
- Demolition waste – minimum 90% diversion from landfill rate;

Pre-demolition Survey Results

- **Main Building: 80% Recyclable**
  - **Wood - (17 02 01)**
    - Window Frames, Doors, Frames around fibreglass signage on outside walls
  - **Plastic - (17 02 03)**
    - PVC Windows and frames, Drain Pipes, Gutters, Roof Facias around the top of the building
  - **Metal - (17 04 02) (17 04 05)**
    - Roof fringing surrounding the top perimeter of the building, Security poles, Heavy stand for the MOT light up sign in the existing car park, Flat wall signs, Copper pipes, Blue bi-fold doors to the smaller entrace to the main building, the steel frame/lintels in between the inside drywalls and outside walls, Steel shutters rolling to main workshop
  - **Inert/Rubble - (17 01 01) (17 01 02)**
    - Bricks and concrete of the main carcass of the building
  - **Glass - (17 02 02)**
    - Windows

- **The Outside Building: 80% Recyclable**
  - **Wood - (17 02 01) (20 01 38)**
    - Window frame and doors
  - **Metal - (16 01 18) (16 01 17). (16 07 99) (17 04 11)**
    - Storage tank, door handles, pipes and taps, cables running outside from the outside building to main building
  - **Inert/Rubble - (17 01 07) (17 09 04) (17 01 03) (17 01 02) (17 01 01)**
    - Bricks, Concrete, Tiles, Sink and Toilet
  - **Plastic - (17 02 03)**
    - Gutters, Plastic facias on top perimeter of the building

Operational Waste

A space for reuse and recycling has been included for the residents exclusive use.

f. Flood Risk

The development site is located in a Low Flood Risk Area with a Low risk of Surface Water Flooding, as determined on the Environment Agency Flood Risk Map. No surface watercourses are present in the vicinity of the site that could be considered as a drainage option for controlled discharge.

Any remaining surface water runoff will continue to be discharge into the existing surface water drainage network as this is considered to be the most appropriate drainage option. Greening and biodiversity measures will help to absorb some surface water runoff and reduce the overall discharge, through measures such as green roofs and planting which will help to separate rainwater form wastewater, reducing the load on sewers. Similarly, a small soakaway will be included to absorb any excess surface water not controlled by the on-site greening measures. Passive grease traps will be installed in individual kitchens to help prevent fats, oils and grease from entering the sewer system that could lead to clogging.

g. Sustainable Procurement

It is expected that all timber used in the development will come from a legal Source (FSC Scheme). At least 80% of the building materials will be responsibly sourced and will use suppliers who can provide an EMS certificate or equivalent. Materials rated with an A or B in the BRE Green Guide to Specification will be preferred.

Other measures will be implemented:

- The reuse of existing materials from the demolition of existing buildings
- At least 20% of the total value of materials used should derive from recycled and reused content in the products and materials selected;
- Steel will have a high recycled content;
- Concrete will have a Ground Granulated Blast Furnace Slag (GGBS) value of 50%.

h. Biodiversity and Green Infrastructure

In accordance with London Plan Policy 5.3 Sustainable Design and Construction, the highest standards should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime. This section investigates how the development proposal considers sustainable design principles set out in the Sustainable Design and Construction SPG (2014).

In accordance with London Plan Policy 5.11 major development proposals should be designed to include roof, wall and site planting. Particularly green roofs and walls where feasible. Vegetated roofs, including terraces and gardens, can improve the thermal performance of the building, reduce the urban heat island effect, support sustainable urban drainage by absorbing rainfall to reduce flooding, enhance biodiversity, provide amenity for residents who may not have access to private gardens, provide opportunities to grow food and improve appearance.

Biodiversity

The proposed development will incorporate measures to support and enhance the environment through consideration of the existing site, including measures to mitigate the impact of the development and enhance site biodiversity.

The existing site is a brownfield site with a baseline biodiversity score of 0. The site has potential to incorporate measures to increase on-site biodiversity and add to the biodiversity infrastructure of the area. As the site location within the borough is adjacent to an Ecological Corridor, it holds importance in supporting this infrastructure. There are some site constraints in that there is little to no amenity space. However, the surface area of the development has great potential for incorporating biodiversity measures. A biodiverse green roofs of up to 96m² can be included alongside an area of green wall. Effort will also be made to plant species rich native flora to attract pollinators and other local wildlife, to aid in supporting the nearby Ecological Corridor.

i. Urban Greening

Urban Greening Factor

The scheme has an UGF of 0.4. The table below summarise the measures to be implemented within the development.

Table 15. Urban Greening Factor Calculator

Urban Greening Factor Calculator				
Surface Cover Type	**Factor**	**Area (m²)**	**Contribution**	**Notes**
Semi-natural vegetation (e.g. trees, woodland, species-rich grassland) maintained or established on site.	1	0	0	
Wetland or open water (semi-natural; not chlorinated) maintained or established on site.	1	0	0	
Intensive green roof or vegetation over structure. Substrate minimum settled depth of 150mm.	0.8	96	76.8	
Standard trees planted in connected tree pits with a minimum soil volume equivalent to at least two thirds of the projected canopy area of the mature tree.	0.8	0	0	
Extensive green roof with substrate of minimum settled depth of 80mm (or 60mm beneath vegetation blanket) – meets the requirements of GRO Code 2014.	0.7	0	0	
Flower-rich perennial planting.	0.7	0	0	
Rain gardens and other vegetated sustainable drainage elements.	0.7	0	0	
Hedges (line of mature shrubs one or two shrubs wide).	0.6	0	0	
Standard trees planted in pits with soil volumes less than two thirds of the projected canopy area of the mature tree.	0.6	0	0	
Green wall –modular system or climbers rooted in soil.	0.6	100	60	
Groundcover planting.	0.5	0	0	
Amenity grassland (species-poor, regularly mown lawn).	0.4	0	0	
Extensive green roof of sedum mat or other lightweight systems that do not meet GRO Code 2014.	0.3	0	0	
Water features (chlorinated) or unplanted detention basins.	0.2	0	0	
Permeable paving.	0.1	0	0	
Sealed surfaces (e.g. concrete, asphalt, waterproofing, stone).	0	1	0	
Total contribution			**136.8**	
Total site area (m²)			390	
Urban Greening Factor			**0.4**	

6. OVERHEATING ASSESSMENT

a. Cooling Hierarchy

Policy SI 4 Managing Heat Risk

B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
   1) Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
   2) Minimise internal heat generation through energy efficient design
   3) Manage the heat within the building through exposed internal thermal mass and high ceilings
   4) Provide passive ventilation
   5) Provide mechanical ventilation
   6) Provide active cooling systems

The hierarchy, in relation to the development is explored below.

A dynamic assessment has been undertaken to determine if the units within the development are at risk of overheating under current and future climate conditions spanning the anticipated lifetime of the building.

1. Reduce the amount of the heat entering a building in summer

The orientation of the building has been designed to reduce the amount of the heat entering the building in summer. Internal shading such as blinds could be used within the space. Green walls and roofs will help to reduce the amount of heat being absorbed.

2. Minimise internal heat generation through energy efficient design

Internal heat generation is minimised through energy efficient design

3. Manage the heat within the building

The building will be designed to as a high thermal mass, which may help to limit the internal temperature.

4. Passive ventilation

The results of the modelling confirm that the overheating criteria can be met with the use of passive ventilation to achieve thermal comfort for the users. The commercial spaces are single aspect and the residential units are majority dual aspect rooms providing opportunities for cross ventilation. However, due to noise constraints of opening windows along Bedford Road, there is an overheating risk during periods where the windows are not openable.

5. Mechanical ventilation

The results of the modelling confirm that there is a need for mechanical ventilation in the residential units. Details are presented in section's b and c below.

6. Active cooling

The results of the modelling confirm there is a need for commercial active cooling. Details are presented in the section's b and c below.

The performance of the units has been assessed to assess the current situation, a model has been carried out in accordance with the criteria set out in CIBSE TM52, TM59 AND TM49. Results are presented in the following two sections.

b. TM52

The CIBSE TM52 methodology was used in assessment of overheating risk for commercial units. The units are required to pass the below criteria:

Criterion 1: The number of hours the operative temperature exceeds the threshold comfort temperature by 1°C or more should not exceed 3% of annual occupied hours.

Criterion 2: The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability. The Daily Weighted Exceedance value must not exceed 6 in any given day.

Criterion 3: The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable. The operative temperature must not exceed the adaptive comfort temperature by more than 4°C for more than any 1% of occupied hours.

Building Category: Category II - all units: Normal expectation

Modelling Information
The design variables assessed in order to achieve thermal comfort compliance are:
– Building U-Values
– The g-value (total transmittance) of the glazing
– The mechanical ventilation
– The natural ventilation requirements

Weather File & Description
3 weather files from the CIBSE TM49 document have been used. Due to the location of the development, weather files from the London Weather Centre weather station have been used:

- London_LWC_DSY1 – Central London Weather data: 2020 Moderately warm summer
- London_LWC_DSY2 – Central London Weather data: 2050 featuring short intense warm spell
- London_LWC_DSY3 – Central London Weather data: 2080 featuring long, less intense warm spell

Cooling Hierarchy
The development should follow the reduction of potential overheating wherever possible, as follows:

I. Internal gains are minimised through use of energy efficient fixtures and fittings. Including, LED lighting fixtures, Energy efficient office equipment, BREEAM compliant energy efficient fixtures and fittings where applicable.
II. Design will look to manage heat as effectively as possible through use of high efficiency building fabric.
III. The building façade is sealed both due to noise and air quality concerns. All the above measures are employed to minimise the requirement for cooling.

Retail Spaces
The temperature in the retail area is maintained between 22°C and 24°C during operational hours from 06:00 to 18:00. Lighting is active from 08:00 to 18:00, with a maximum sensible gain of 50 W/m², covering both display and general lighting.
The space is modelled for continuous occupancy, with occupancy gains set at 90W sensible and 50W latent per person, based on an occupancy density of 3 m² per person to reflect peak usage.
Equipment loads within the retail area are estimated at 10 W/m². Cooling demand estimate for each commercial unit is 12-20 kW.

Circulation
Circulation areas are not conditioned.

Passive Cooling Measures

Tables 18-20 in Appendix 2 demonstrate the model baseline without active cooling – with all passive measures maximised such as:
Building Fabric and Envelope Optimization

- **High Thermal Mass:** Using dense materials to absorb heat during the day and release it at night.
- **Reflective Roofs & Walls:** Light-colored or cool roofing materials reduce solar absorption.
- **High-Performance Insulation:** Proper insulation minimizes heat gains in summer while maintaining energy efficiency.
- **Optimized Window-to-Wall Ratio:** Reducing excessive glazing, especially on south and west facades, minimizes heat gain.

Solar Control Shading

- **External Shading:** Fixed external louvres to block direct sunlight.

Results
The results show that in both the 2020's and 2050's scenario the building meets compliance requirements. However, at the 2080s scenario the building fails to meet the requirements, see Table 20.

Challenges & Key design considerations with no mechanical cooling and no openable windows:

- **Ventilation Effectiveness** – Fixed louvres must provide enough fresh air and avoid stagnant heat buildup.
- **Limited Heat Removal** – Without openable windows, **night-time purge ventilation** is not possible, increasing the risk of overheating.
- **Glazing & Solar Gain Control** – If the unit has **large shopfront glazing**, it can lead to high heat gains.

Active Cooling Measures

Tables 21-23 in Appendix 2 demonstrate the model baseline with the proposed ventilation strategy.

Proposed Ventilation Strategy

Windows
The windows are sealed to address concerns around air quality and noise, so they are not used for thermal comfort control in this development. Even if windows could be opened, the internal gains typical of retail units would prevent natural ventilation from effectively managing indoor temperatures, especially in internal areas. This issue is amplified during peak summer periods when outdoor temperatures exceed desired indoor levels. Combined with solar and internal gains, this would result in uncomfortable indoor temperatures during peak summer and for periods on either side.

Mechanical Ventilation
The windows are sealed and therefore do not contribute to thermal comfort control in this development. Additionally, the mechanical ventilation system operates without cooling capabilities, meaning it cannot regulate internal temperatures when supplying air at ambient outdoor conditions. This limitation is especially pertinent during peak summer periods, when external temperatures exceed the preferred indoor levels. Combined with solar and internal heat gains, this results in internal temperatures that are likely to be uncomfortable during peak summer and for some time on either side of this period.

Mechanical Cooling
As a result of the factors mentioned above, it is proposed to implement cooling measures at No 13 Bedford development to ensure comfortable internal temperatures. Significant efforts have been made to reduce cooling demand, and energy-efficient cooling and ventilation systems have been selected to minimize energy consumption.

Results

The results show that with active cooling, the unit shows an acceptable level of overheating risk at each scenario; 2020s, 2050s and 2080s, demonstrating that active cooling is the most appropriate method of cooling in order to achieve future proofed overheating mitigation.

c. TM59 & TM49

This report presents an overheating assessment for the proposed development, ensuring compliance with **CIBSE TM59 (Design Methodology for the Assessment of Overheating Risk in Homes)** and **CIBSE TM49 (Design Summer Year Weather Files for London)**. The assessment follows the guidelines set out in the **GLA Energy Assessment Guidance (Section 8.10)** and **Haringey's Overheating Planning Application Requirements**.
The report evaluates compliance using **CIBSE TM59 criteria**, assessing internal temperatures against the **TM49 DSY1 2020s weather file** and considering future climate resilience with **DSY2, DSY3 (2020s) and DSY1 (2050s)**. The **cooling hierarchy** has been correctly applied, prioritizing passive measures before mechanical cooling solutions.

CIBSE TM59 provides two main criteria to evaluate overheating risk in residential buildings, aiming to address different types of spaces and occupancy patterns. These criteria apply to both ventilated and non-ventilated residential units.

A. **Living rooms, Kitchens and Bedrooms:** The number of hours () during which Δ is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. Please refer to CIBSE TM59.
B. **Bedrooms only:** The operative temperature in the bedroom between 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Assessment Standard: CIBSE TM59.
Weather Files Used (CIBSE TM49):
- DSY1 2020s (baseline compliance scenario).
- DSY2 & DSY3 2020s (extreme events).
- DSY1 2050s (future climate resilience scenario).

Software Used: DesignBuilder.
Assumptions:

- Internal heat gains from occupants, lighting, and appliances.
- Ventilation rates based on TM59 guidance.
- Windows assumed to be openable based on specified constraints.

Table 16: Internal Gains for Residential areas as set out by CIBSE TM59

Unit/Room Type	Occupancy	Sensible/ Latent Gain (W/ppl)	Equipment Load
1 – Bedroom Apartment: Living Room/Kitchen	1 person from 9am to 10pm; room is unoccupied for the rest of the day.	75/55	Peak load of 450 W from 6pm to 8pm; 200 W from 8pm to 10pm; 110 W from 9am to 6pm and from 10pm to 12pm; Base load of 85 W for the rest of the day.
2 – Bedroom Apartment: Living Room/Kitchen	2 people from 9am to 10pm; room is unoccupied for the rest of the day.	75/55	Peak load of 450 W from 6pm to 8pm; 200 W from 8pm to 10pm; 110 W from 9am to 6pm and from 10pm to 12pm; Base load of 85 W for the rest of the day.
Double Bedroom	2 people at 70% gains from 11pm to 8am, 2 people at full gains from 8am to 9am and from 10pm to 11pm, 1 person at full gain in the bedroom from 9am to 10pm.	75/55	Peak load of 80 W from 8am to 11pm; Base load of 10 W during the sleeping hours.
Single Bedroom	1 person at 70% gains from 11pm to 8am, 1 person at full gains from 8am to 11pm.	75/55	Peak load of 80 W from 8am to 11pm; Base load of 10 W during the sleeping hours.

Communal Corridors Pipework Losses
There is no pipework heat losses present at the proposed development. Other considerations include:

- Lighting 2 W/m2;

Auxiliary Ventilation Rates
Fresh air supply is assigned to the areas below as background ventilation

Table 17: Auxiliary Ventilation

Location	Auxiliary Ventilation
Residential Areas	0.3 L/s/m2 (min. Part F)

For the purposes of this study, the limiting cooling capacity for all scenarios for residential areas is set to 18W/m2 with the cooling set point of 23 degrees.

Spaces Analysed

The proposed development includes a total of 12 apartments. The units with higher risk of overheating are those with the highest proportion of glazing facing southwest or west orientation, on the topmost floors, with limited shading and with security and privacy limitations. In addition, bedrooms facing Bedford Road will be closed at night and therefore cannot provide the purge ventilation to the rooms to prevent overheating in summer. These rooms are provided with mechanical ventilation to provide 4 air changes per hour. The living rooms facing Bedford Road can be ventilated by open windows but should be provided with means of background ventilation with acoustic vents.

Communal corridors

CIBSE TM59 describes that communal corridors can have a significant overheating risk if the operative temperature exceeds 28oC for more than 3% of total annual hours. However, it has been understood that the corridors leading to the proposed apartments are external.

Scenario 1: Unconstrained Windows (Baseline Scenario - DSY1 2020s)

- Openable windows with no constraints.
- Passive mitigation measures applied to achieve compliance. Such as: brise soleil, **low g-value** glazing (solar control glass) to minimize heat entry, **energy-efficient lighting (LEDs)** to minimize heat from artificial lighting, - **low-energy appliances** to reduce internal heat sources.

Results

The summary of results for dining/living rooms and kitchens (Criteria A) and bedrooms (Criteria B), show that the units meet the required criteria. However, due to noise constraints leading to the windows not being openable this scenario is not suitable. See tables 24 and 25 in Appendix 2.

Scenario 2: Policy-Compliant (Constrained) Scenario – DSY1 2020s

Assumptions:

- Bedroom windows closed at night per noise mitigation requirements.
- Background ventilation only in Living/Kitchen/Dining (LKD) areas.

Results

The summary of results for dining/living rooms and kitchens (Criteria A) and bedrooms (Criteria B), show that the units fail to meet the required criteria. This demonstrates that passive daytime ventilation is not sufficient to provide adequate cooling. See tables 26 and 27 in Appendix 2. In line with the cooling hierarchy, further mitigation methods must be implemented in order to achieve adequate cooling levels.

Mitigation Strategy (Cooling Hierarchy Applied in Order) – DSY2020a

- **External shading (brise soleil).**

Results

The summary of results for dining/living rooms and kitchens (Criteria A) and bedrooms (Criteria B), show that the units fail to meet the required criteria. This demonstrates that further passive methods are not sufficient to provide adequate cooling. See tables 28 and 29 in Appendix 2. In line with the cooling hierarchy, further mitigation methods must be implemented in order to achieve adequate cooling levels.

Mitigation Strategy (Cooling Hierarchy Applied in Order) – DSY2020a

- **Mechanical Cooling**

Results
The summary of results for dining/living rooms and kitchens (Criteria A) and bedrooms (Criteria B), show that the units meet the required criteria. This demonstrates that mechanical cooling is required in order to meet cooling requirements. See tables 30 and 31 in Appendix 2.

Scenario 3: Future Climate Resilience (DSY2, DSY3 2020s & DSY1 2050s)

- Assessment of future overheating risk using TM49 extreme weather files.

Several design features are implemented to minimise cooling requirement and improve thermal comfort to the occupants:

- Optimum glazing ratio balancing solar gains for daylighting and reducing cooling loads;
- Internal blinds fully covering the windowpanes for the residential accommodation;
- Natural ventilation through openable windows, wherever possible.
- The floor to ceiling height has been maximised, wherever possible to properly accommodate for building services.
- Natural ventilation is possible through openable windows within the residential areas. Cross ventilation is facilitated in dual aspect flats, wherever possible. **However, due to high external noise levels, the potential for natural ventilation can be limited, therefore, mechanical ventilation is provided.**
- High efficiency mechanical background ventilation combined with the heat pump is proposed for fresh air supply all year around.
- A limited level of comfort cooling is proposed to the residential areas for future proofing to cope with climate uncertainty as well as to mitigate noise issues on site. However, passive measures have been applied to all spaces to minimise cooling demand.

Results
All zones and rooms in the residential building pass both criteria of TM59 and TM49 demonstrating an acceptable level of overheating risk under this scenario. See tables 32-37 in Appendix 2.

d. Summary

Results show that the units demonstrate an acceptable level of overheating risk against the CIBSE TM52, TM59 and TM49 with the use of mechanical ventilation or active cooling.

Furthermore, the development proposal will minimise adverse impacts on the urban heat island through the use of optimised insulation, cross ventilation, improved window u-values, higher air tightness, reduced cold bridging, green infrastructure and light coloured materials.

e. Proposed Retrofit Measures

Future Retrofit Plan

- The future adaptation plan excludes MVHR, as it is already included in the design.
- Instead, recommendations include:
- Further improvements to external shading.
- Use of higher-performing glazing.
- Additional passive ventilation measures.
- Optimized external wall U-values instead of future insulation retrofitting

Solar Shading and Window Films

- Install external shading (e.g., brise-soleil, retractable awnings) and high-performance window films to reduce solar heat gain.
- Installation Process: Can be fitted externally on existing window frames with minimal disruption to tenants.
- Impact on Overheating: Reduces direct solar gain by up to 30-40%, lowering indoor temperatures and reducing reliance on active cooling.
- Lifecycle & Replacement: Window films should be replaced every 10-15 years; external shading has a lifespan of 20-25 years.
- Responsibility: Building management to oversee installation, maintenance, and replacement cycles.

Enhanced Natural Ventilation

- Introduce automated window actuators for nighttime ventilation and cross-ventilation to cool units naturally during cooler evening hours.
- Installation Process: Automated windows can be retrofitted into existing frames; sensor-controlled systems linked to external temperatures can be installed with minor structural adjustments.
- Impact on Overheating: Reduces nighttime indoor temperatures by up to 5°C during peak summer.
- Lifecycle & Replacement: System maintenance every 5 years, with full replacement every 15-20 years.
- Responsibility: Building management to ensure regular operation checks and sensor calibration.

High-Performance Insulation for Roof and External Walls

- Install reflective roof coatings and upgrade wall insulation to reduce heat transfer.
- Installation Process: Insulation retrofitting for walls and roofs; likely requires temporary access to units or external scaffolding.
- Impact on Overheating: Prevents heat transfer, reducing interior temperatures by up to 2-3°C.
- Lifecycle & Replacement: 25-30 years for insulation, with minimal maintenance required.
- Responsibility: Building owner or management to oversee installation, compliance, and performance checks.

Energy-Efficient Mechanical Ventilation with Heat Recovery (MVHR)

- Install MVHR units with summer bypass functions to improve ventilation efficiency without introducing excessive heat.
- Installation Process: Install in each apartment unit, requiring some internal adjustments for ducting.
- Impact on Overheating: Provides fresh, filtered air and reduces indoor temperatures without high energy usage.
- Lifecycle & Replacement: Filters changed annually; unit replacement every 15 years.
- Responsibility: Building management to coordinate regular maintenance and filter replacements.

Low-Energy Cooling Units as a Backup

- Install low-energy cooling units as a last resort for extreme heat events.
- Installation Process: Wall-mounted units that require minimal modifications to existing structures.
- Impact on Overheating: Provides immediate relief on days when passive measures are insufficient.
- Lifecycle & Replacement: Units to be serviced every 2 years; full replacement every 10-15 years.
- Responsibility: Building management to oversee use and upkeep of units, with energy efficiency monitoring.

Implementation Timeline

- Year 1: Install window films, solar shading, and upgrade insulation in all units.
- Year 2: Install automated window actuators and initiate the MVHR system setup.
- Year 3: Complete MVHR installations and set up backup low-energy cooling units.

Maintenance and Lifecycle Replacement Schedule

- Short-term (5-10 years): Annual inspection of automated windows, MVHR filters, and low-energy cooling units.
- Mid-term (10-20 years): Replace window films (year 10), service insulation if needed (year 15).
- Long-term (20+ years): Replace automated ventilation and shading systems.

Responsibility for Overheating Risk

- Building Management: Responsible for overseeing implementation, maintenance, and replacement of retrofit measures. Also tasked with monitoring indoor temperatures and conducting regular overheating risk assessments in line with evolving climate projections.
- Occupants: Educated on how to use passive and active measures effectively, such as opening windows during cooler times and managing shading devices.
- External Consultants: Engaged periodically (e.g., every 5 years) to assess system efficiency and recommend upgrades based on the latest climate data and energy standards.

Monitoring and Evaluation

- Install temperature and humidity sensors in each unit to track real-time data and evaluate the effectiveness of each measure.
- Annual report assessing internal temperatures during summer, system performance, and any new retrofit needs.

f. Heatwave Plan

The Heatwave Plan is a proactive strategy that includes actions to be taken during periods of high temperatures, aiming to minimize discomfort and health risks for occupants.

1. **Temperature Monitoring and Alerts**
    - **Objective**: Track indoor temperatures, especially in common areas and more heat-sensitive zones.
    - **Process**: Install temperature sensors with threshold alerts that notify building management and occupants when temperatures exceed safe limits (e.g., above 27°C).
    - **Response**: If thresholds are exceeded, activate measures outlined in the Heatwave Plan, such as encouraging residents to use cooling systems.
2. **Occupant Notifications and Guidance**
    - **Objective**: Inform occupants of upcoming heatwave risks and actions to take.
    - **Communication Channels**: Use email, mobile notifications, or posters in common areas to inform residents of the heatwave forecast and provide relevant advice.
    - **Guidance**: Share tips on keeping cool, such as using blinds, reducing appliance use, and staying hydrated.
3. **Activation of Passive and Mechanical Cooling Measures**
    - **Automated Systems**: Activate automated window actuators and ventilation systems to maximize nighttime cooling.
    - **Mechanical Cooling**: Use low-energy cooling units as needed and provide guidance on efficient use.
    - **Shading**: Ensure all shading devices are fully functional and instruct residents on proper use to minimize solar heat gain.
4. **Common Area Preparation**
    - Designate common areas as cool zones with additional ventilation or temporary cooling units.
    - Encourage occupants, especially those in upper floors or internal units, to use these areas during peak heat times.
5. **Emergency Procedures**
    - **Health Support**: Contact information for local health services and guidance on managing heat-related illnesses.
    - **Escalation**: If extreme temperatures persist, provide relocation options to cooler areas or emergency accommodations.

g. Building User Guide

The Building User Guide serves as a comprehensive manual for occupants to help them manage their spaces to prevent and mitigate overheating, using both passive and active systems.

Key Sections of the Building User Guide:

1. **Overview of Overheating Risks**
    - Briefly explain overheating risk, why it's a concern in this development, and outline the key systems and features in place to mitigate this risk.
2. **Guide to Passive Cooling Measures**
    - **Natural Ventilation**: Instructions on when and how to use automated or manually operated windows, particularly for nighttime cooling.
    - **Shading Use**: Guidance on deploying external blinds, shades, and reflective window films effectively during hot days.
3. **Using Mechanical Cooling Systems Efficiently**
    - **Cooling Units**: Instructions on adjusting cooling units to optimize comfort without overuse, including recommended settings.
    - **MVHR System**: Explanation of the MVHR summer bypass function and advice on settings for warm days.
4. **Tips for Reducing Internal Heat Gains**
    - Encourage efficient appliance use, minimizing lighting during peak hours, and other energy-efficient practices that reduce internal heat.
5. **Health and Safety Tips for Heatwaves**
    - Provide tips for staying hydrated, dressing in cool clothing, and recognizing signs of heat-related illnesses.
    - Offer practical advice on safe practices during extreme heat, such as prioritizing cool areas and avoiding unnecessary physical activity.
6. **Contact Information for Assistance**
    - Provide contacts for building management, emergency services, and local health resources for quick assistance if needed.

h. Implementation and Review

- **Distribution**: Provide a digital and physical copy of the Building User Guide to each occupant at the start of tenancy.
- **Annual Review**: Update the Heatwave Plan and Building User Guide annually to reflect new climate data, technology updates, and any changes in building systems.
- **Occupant Feedback**: Gather feedback from residents on the usability of these guides and adjust content as needed.

By implementing both a Heatwave Plan and a Building User Guide, the development can offer clear, actionable steps for occupants, reducing overheating risk and improving comfort during warmer seasons.

7. CONCLUSION

The development has been designed to exceed Part L building regulations requirements. In line with the national and local policies, regulated CO_2 emissions from the development will be reduced by **82%** from the notional emissions once energy efficiency measures and lean measures are taken into account.

The use of air source heat pumps and photovoltaic panels are to be incorporated in the design because they achieve a CO2 percentage reduction of **57%** contributing to the overall reduction of **82%** in carbon emissions. The remainder is made up from a fabric first approach with U-values outlined in the specification column of Tables 5 and 6 on Page 11 of this report.

An appraisal of the proposed development has been undertaken against key sustainability objectives identified from relevant policy guidance. The framework for the appraisal was guided by the National Plan. This process has ensured that the development responds to the sustainable development objectives that are relevant to the area. Key sustainability initiatives in ecology, waste management, water, health and wellbeing, materials, pollution and Surface water management have been incorporated in the design of the proposed Development.

8. APPENDIX

1a. Baseline SAP/SBEM Calculations
1b. Be Lean SAP/SBEM Calculations
1c. Be Green SAP/SBEM Calculations
2. Full Overheating Calculations

1a. Baseline SAP/SBEM Calculations

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 1	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	14.80	**TER**	13.59
Environmental	89 B	**% DER < TER**			-8.90
CO_2 Emissions (t/year)	0.77	**DFEE**	32.76	**TFEE**	29.08
Compliance Check	See BREL	**% DFEE < TFEE**			-12.64
% DPER < TPER	-9.03	**DPER**	79.53	**TPER**	72.94

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
						(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	158.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			15.6000	1.1450	17.8626			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1800	6.8742	70.0000	2673.3000	(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.5448			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			61.0000			30.0000	1830.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12845.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		210.5820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.3000	2.4600
E3 Sill	4.0300	0.0400	0.1612
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680

E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8348 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 35.3796 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	67.5662	67.3325	67.1035	66.0277	65.8264	64.8894	64.8894	64.7159	65.2503	65.8264	66.2336	66.6593	(39)

Average = Sum(39)m / 12 = 66.0267

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1076	1.1038	1.1001	1.0824	1.0791	1.0638	1.0638	1.0609	1.0697	1.0791	1.0858	1.0928	(40)
HLP (average)												1.0824	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

26.3466	25.9553	25.4043	24.3884	23.6276	22.7841	22.3284	22.8756	23.4714	24.3740	25.4109	26.2576	(42b)

Hot water usage for other uses

37.0652	35.7174	34.3696	33.0218	31.6739	30.3261	30.3261	31.6739	33.0218	34.3696	35.7174	37.0652	(42c)

Average daily hot water use (litres/day) 118.1951 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.5682	125.8499	122.5242	117.4304	113.3071	108.8690	107.1363	110.4473	113.9432	118.6060	123.7793	128.2294	(44)
Energy conte	203.6205	179.2085	188.3151	160.7563	152.5332	133.8672	129.5721	136.7569	140.5033	160.9472	176.3463	200.7763	(45)
Energy content (annual)										Total = Sum(45)m =		1963.2030	
Distribution loss (46)m = 0.15 x (45)m	30.5431	26.8813	28.2473	24.1134	22.8800	20.0801	19.4358	20.5135	21.0755	24.1421	26.4519	30.1164	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	254.5794	225.2359	239.2740	210.0714	203.4921	183.1822	180.5310	187.7158	189.8184	211.9061	225.6614	251.7352	(62)
WWHRS	-50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	204.3391	180.8030	192.7464	171.5447	167.5866	152.4576	151.7316	157.0905	158.0296	174.4305	183.2062	202.4253	(64)
									Total per year (kWh/year) = Sum(64)m =			2096.3912	(64)
12Total per year (kWh/year)												2096	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	80.4436	71.0937	75.3545	65.7802	63.4570	56.8396	55.8224	58.2114	59.0461	66.2547	70.9639	79.4979	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	108.1231	105.7942	101.2829	91.3615	85.2917	78.9439	75.0302	78.2411	82.0085	89.0520	98.5610	106.8520	(72)
Total internal gains	428.2257	437.1991	418.6181	401.8787	380.5290	362.5425	347.9372	349.3274	360.6328	377.4942	402.2831	419.2128	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	540.5282	637.8969	714.1156	796.3586	843.4176	830.0471	795.4425	745.4331	690.8012	605.3364	538.6075	514.0943	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	52.8104	52.9936	53.1745	54.0409	54.2061	54.9889	54.9889	55.1363	54.6847	54.2061	53.8729	53.5289

alpha	4.5207	4.5329	4.5450	4.6027	4.6137	4.6659	4.6659	4.6758	4.6456	4.6137	4.5915	4.5686	
util living area	0.9810	0.9607	0.9205	0.8228	0.6715	0.4902	0.3570	0.3961	0.6176	0.8684	0.9627	0.9844	(86)
MIT	19.7886	20.0448	20.3596	20.7075	20.9066	20.9829	20.9969	20.9950	20.9519	20.6762	20.1818	19.7529	(87)
Th 2	19.9946	19.9977	20.0008	20.0152	20.0179	20.0305	20.0305	20.0329	20.0257	20.0179	20.0124	20.0067	(88)
util rest of house	0.9761	0.9512	0.9020	0.7864	0.6151	0.4200	0.2793	0.3144	0.5424	0.8315	0.9521	0.9803	(89)
MIT 2	18.9154	19.1671	19.4696	19.7960	19.9594	20.0229	20.0297	20.0314	20.0013	19.7803	19.3157	18.8899	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	19.2733	19.5268	19.8344	20.1696	20.3476	20.4163	20.4261	20.4263	20.3909	20.1475	19.6707	19.2436	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2733	19.5268	19.8344	20.1696	20.3476	20.4163	20.4261	20.4263	20.3909	20.1475	19.6707	19.2436	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9717	0.9459	0.8985	0.7926	0.6347	0.4484	0.3112	0.3479	0.5715	0.8369	0.9476	0.9764	(94)
Useful gains	525.2475	603.3975	641.6286	631.1579	535.3459	372.1523	247.5233	259.3184	394.8140	506.6219	510.3966	501.9644	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1011.6877	984.8606	894.7832	744.1042	569.2396	377.4177	248.2707	260.5652	410.4824	628.4778	832.5991	1002.7947	(97)
Space heating kWh	361.9115	256.3432	188.3470	81.3213	25.2169	0.0000	0.0000	0.0000	0.0000	90.6608	231.9858	372.6178	(98a)
Space heating requirement - total per year (kWh/year)												1608.4042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	361.9115	256.3432	188.3470	81.3213	25.2169	0.0000	0.0000	0.0000	0.0000	90.6608	231.9858	372.6178	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1608.4042	
Space heating per m2											(98c) / (4) =	26.3673	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	361.9115	256.3432	188.3470	81.3213	25.2169	0.0000	0.0000	0.0000	0.0000	90.6608	231.9858	372.6178	(98)
Space heating efficiency (main heating system 1)	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)	436.0380	308.8472	226.9241	97.9775	30.3818	0.0000	0.0000	0.0000	0.0000	109.2299	279.5009	448.9371	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	204.3391	180.8030	192.7464	171.5447	167.5866	152.4576	151.7316	157.0905	158.0296	174.4305	183.2062	202.4253	(64)
Efficiency of water heater												79.4000	(216)
(217)m	84.6898	84.2268	83.4296	81.9764	80.4280	79.4000	79.4000	79.4000	79.4000	82.1455	83.9860	84.7680	(217)
Fuel for water heating, kWh/month	241.2795	214.6620	231.0288	209.2610	208.3684	192.0121	191.0977	197.8470	199.0297	212.3433	218.1389	238.7993	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	21.8087	17.4957	15.7530	11.5413	8.9148	7.2835	8.1324	10.5708	13.7304	18.0151	20.3480	22.4148	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.7341	-19.7248	-31.2682	-38.5393	-44.2963	-42.3476	-41.7691	-37.9959	-31.7308	-23.9024	-14.5624	-10.7804	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.7965	-8.6135	-18.6709	-30.2892	-41.9926	-42.9056	-42.1883	-34.5957	-23.8521	-12.8117	-5.2016	-2.9430	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1937.8364	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2553.8678	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	53.3000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	98.3000	(231)
Electricity for lighting (calculated in Appendix L)	176.0085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-617.5120	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4148.5007	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1937.8364	0.2100	406.9456	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2553.8678	0.2100	536.3122	(264)
Space and water heating			943.2579	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	176.0085	0.1443	25.4035	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-349.6512	0.1328	-46.4255	
PV Unit electricity exported	-267.8609	0.1239	-33.1967	
Total			-79.6222	(269)
Total CO2, kg/year			902.6746	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.8000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1937.8364	1.1300	2189.7551	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2553.8678	1.1300	2885.8707	(278)
Space and water heating			5075.6258	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	176.0085	1.5338	269.9678	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-349.6512	1.4906	-521.1963	
PV Unit electricity exported	-267.8609	0.4548	-121.8301	
Total			-643.0265	(283)
Total Primary energy kWh/year			4851.2753	(286)
Dwelling Primary energy Rate (DPER)			79.5300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)

TER Opening Type			12.9100	1.1450	14.7824		(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584		(29a)
Total net area of external elements Aum(A, m2)			56.1300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.4808		(33)
Main dwelling							
Party Wall 1			32.7900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			220.5820	(35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100	
E3 Sill	4.0300	0.0500	0.2015	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.8251	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	30.3059	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	62.4925	62.2589	62.0298	60.9540	60.7527	59.8157	59.8157	59.6422	60.1766	60.7527	61.1599	61.5856	(39)
Average = Sum(39)m / 12 =												60.9530	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0206	1.0169	0.9992	0.9959	0.9806	0.9806	0.9777	0.9865	0.9959	1.0026	1.0096	(40)
HLP (average)												0.9992	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0098	(42)
Hot water usage for mixer showers													
	57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)
Hot water usage for baths													
	25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)
Hot water usage for other uses													
	35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)
Average daily hot water use (litres/day)												108.6142	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m													
	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.1691	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	238.0923	210.6907	223.9644	197.0124	191.0935	172.2990	169.2359	176.6483	178.4640	198.8945	211.3894	235.4858	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
										Total per year (kWh/year) = Sum(64)m =		2157.2560	(64)
12Total per year (kWh/year)												2157	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	74.9616	66.2574	70.2641	61.4381	59.3345	53.2209	52.1320	54.5314	55.2708	61.9283	66.2185	74.0949	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)													
	100.7548	98.5973	94.4409	85.3307	79.7506	73.9179	70.0699	73.2949	76.7650	83.2370	91.9701	99.5899	(72)
Total internal gains													
	421.0597	430.2262	411.9783	396.0569	375.1902	357.7256	343.1791	344.5834	355.5982	371.8814	395.9012	412.1530	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1200	10.6334	0.6300	0.7000	0.7700	6.8894	(74)

East			7.0400		19.6403		0.6300		0.7000		0.7700		42.2563 (76)
South			3.7500		46.7521		0.6300		0.7000		0.7700		53.5801 (78)
Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	523.7855	613.8049	682.2621	756.8684	798.5671	785.3233	752.4852	706.8799	657.5911	580.2867	520.5996	498.9440	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8094	60.0339	60.2555	61.3190	61.5222	62.4859	62.4859	62.6677	62.1111	61.5222	61.1126	60.6901	
alpha	4.9873	5.0023	5.0170	5.0879	5.1015	5.1657	5.1657	5.1778	5.1407	5.1015	5.0742	5.0460	
util living area	0.9837	0.9648	0.9255	0.8247	0.6672	0.4813	0.3488	0.3863	0.6081	0.8695	0.9661	0.9868	(86)
MIT	19.9498	20.1841	20.4665	20.7736	20.9356	20.9903	20.9985	20.9975	20.9693	20.7456	20.3068	19.9188	(87)
Th 2	20.0630	20.0662	20.0693	20.0840	20.0867	20.0995	20.0995	20.1019	20.0946	20.0867	20.0811	20.0753	(88)
util rest of house	0.9795	0.9561	0.9079	0.7892	0.6131	0.4162	0.2779	0.3118	0.5370	0.8332	0.9562	0.9833	(89)
MIT 2	18.8590	19.1540	19.5015	19.8675	20.0356	20.0940	20.0990	20.1010	20.0750	19.8486	19.3224	18.8292	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	19.3061	19.5761	19.8970	20.2389	20.4045	20.4613	20.4677	20.4684	20.4415	20.2162	19.7258	19.2757	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3061	19.5761	19.8970	20.2389	20.4045	20.4613	20.4677	20.4684	20.4415	20.2162	19.7258	19.2757	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9506	0.9042	0.7956	0.6325	0.4426	0.3070	0.3424	0.5649	0.8389	0.9515	0.9794	(94)
Useful gains	510.7226	583.4844	616.9180	602.1517	505.0854	347.5679	230.9843	242.0195	371.4902	486.8075	495.3536	488.6494	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	937.7669	913.7201	831.0143	691.1484	528.8210	350.6002	231.3465	242.6483	381.6118	584.2091	772.1955	928.4484	(97)
Space heating kWh	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98a)
Space heating requirement - total per year (kWh/year)												1379.6673	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1379.6673	
Space heating per m2											(98c) / (4) =	22.6175	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	343.8538	240.1715	172.3892	69.3481	19.1118	0.0000	0.0000	0.0000	0.0000	78.4273	215.7210	354.1238	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.2500	84.7461	83.9041	82.4218	81.0292	80.3000	80.3000	80.3000	80.3000	82.6014	84.4955	85.3327	(217)
Fuel for water heating, kWh/month	248.2289	220.9826	237.7048	214.3952	212.4801	194.4045	191.8535	199.8860	201.3836	216.8783	223.6985	245.5085	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1493.1464	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2607.4045	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3832.7739	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1493.1464	0.2100	313.5607	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2607.4045	0.2100	547.5549	(264)
Space and water heating			861.1157	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			829.2382	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1493.1464	1.1300	1687.2554	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2607.4045	1.1300	2946.3671	(278)
Space and water heating			4633.6225	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4449.3847	(286)
Target Primary Energy Rate (TPER)			72.9400	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 2	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	83 B	**DER**	16.72	**TER**	15.50
Environmental	89 B	**% DER < TER**			-7.87
CO_2 Emissions (t/year)	0.73	**DFEE**	36.56	**TFEE**	32.55
Compliance Check	See BREL	**% DFEE < TFEE**			-12.31
% DPER < TPER	-7.92	**DPER**	90.02	**TPER**	83.41

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	130.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3874	0.3798	0.3722	0.3342	0.3266	0.2887	0.2887	0.2811	0.3038	0.3266	0.3418	0.3570	(22b)
Effective ac	0.5750	0.5721	0.5693	0.5559	0.5533	0.5417	0.5417	0.5395	0.5462	0.5533	0.5584	0.5637	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			16.3200	1.1450	18.6870			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1800	5.7258	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1700	1.3974	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			58.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.6182			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9072.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.4460 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3000	0.3000	3.0900
E3 Sill	6.6300	0.0400	0.2652
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598
E16 Corner (normal)	5.2000	0.0900	0.4680

E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.4380 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	37.0562 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.6693	24.5442	24.4217	23.8462	23.7385	23.2372	23.2372	23.1444	23.4303	23.7385	23.9563	24.1841	(38)
Heat transfer coeff	61.7255	61.6005	61.4779	60.9024	60.7947	60.2935	60.2935	60.2006	60.4865	60.7947	61.0126	61.2403	(39)
Average = Sum(39)m / 12 =												60.9019	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2345	1.2320	1.2296	1.2180	1.2159	1.2059	1.2059	1.2040	1.2097	1.2159	1.2203	1.2248	(40)
HLP (average)												1.2180	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901	(42)
Hot water usage for mixer showers	59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)
Hot water usage for baths	23.9204	23.5652	23.0649	22.1425	21.4518	20.6860	20.2723	20.7691	21.3099	22.1294	23.0709	23.8396	(42b)
Hot water usage for other uses	33.6193	32.3968	31.1742	29.9517	28.7292	27.5067	27.5067	28.7292	29.9517	31.1742	32.3968	33.6193	(42c)
Average daily hot water use (litres/day)												107.2537	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	116.6663	114.1999	111.1824	106.5601	102.8186	98.7914	97.2188	100.2231	103.3951	107.6263	112.3208	116.3589	(44)
Energy conte	184.7709	162.6192	170.8831	145.8754	138.4136	121.4756	117.5778	124.0972	127.4966	146.0478	160.0215	182.1899	(45)
Energy content (annual)										Total = Sum(45)m =		1781.4685	
Distribution loss (46)m = 0.15 x (45)m	27.7156	24.3929	25.6325	21.8813	20.7620	18.2213	17.6367	18.6146	19.1245	21.9072	24.0032	27.3285	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.7190	49.5417	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	235.7298	208.6466	221.8420	195.1905	189.3725	170.1946	167.1194	175.0561	176.8116	197.0067	209.3366	233.1488	(62)
WWHRS	-45.5909	-40.3210	-42.2218	-34.9613	-32.5827	-27.8812	-26.1342	-27.7911	-28.8470	-34.0074	-38.5263	-44.7466	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	190.1389	168.3256	179.6202	160.2291	156.7898	142.3134	140.9852	147.2650	147.9646	162.9993	170.8103	188.4021	(64)
										Total per year (kWh/year) = Sum(64)m =		1955.8435	(64)
12Total per year (kWh/year)												1956	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	74.1760	65.5777	69.5584	60.8323	58.7623	52.5704	51.4800	54.0020	54.7214	61.3006	65.5359	73.3179	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	99.6990	97.5859	93.4924	84.4894	78.9815	73.0144	69.1936	72.5834	76.0019	82.3933	91.0221	98.5455	(72)
Total internal gains	372.5470	379.9185	364.0183	349.2942	330.9646	314.7487	301.9561	303.8181	313.5621	328.6744	350.1251	364.8972	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	505.7804	616.0553	705.9105	795.2556	844.2319	828.5815	795.6964	747.8637	692.1942	595.2670	511.5178	477.6724	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.8273	40.9101	40.9917	41.3790	41.4523	41.7970	41.7970	41.8614	41.6635	41.4523	41.3043	41.1507	

alpha	3.7218	3.7273	3.7328	3.7586	3.7635	3.7865	3.7865	3.7908	3.7776	3.7635	3.7536	3.7434	
util living area	0.9627	0.9282	0.8697	0.7588	0.6123	0.4516	0.3299	0.3648	0.5641	0.8132	0.9346	0.9689	(86)
MIT	19.5399	19.8720	20.2542	20.6403	20.8693	20.9683	20.9925	20.9890	20.9273	20.6005	20.0034	19.4771	(87)
Th 2	19.8925	19.8945	19.8964	19.9056	19.9073	19.9153	19.9153	19.9168	19.9122	19.9073	19.9038	19.9002	(88)
util rest of house	0.9545	0.9137	0.8449	0.7177	0.5547	0.3802	0.2502	0.2814	0.4878	0.7696	0.9187	0.9619	(89)
MIT 2	18.6048	18.9254	19.2858	19.6375	19.8245	19.9006	19.9131	19.9134	19.8746	19.6169	19.0655	18.5496	(90)
Living area fraction									fLA = Living area / (4) =			0.5200	(91)
MIT	19.0910	19.4176	19.7894	20.1589	20.3678	20.4558	20.4744	20.4727	20.4220	20.1283	19.5532	19.0319	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0910	19.4176	19.7894	20.1589	20.3678	20.4558	20.4744	20.4727	20.4220	20.1283	19.5532	19.0319	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9472	0.9064	0.8422	0.7278	0.5797	0.4163	0.2916	0.3246	0.5245	0.7792	0.9127	0.9551	(94)
Useful gains	479.0981	558.3689	594.4996	578.7646	489.3698	344.9154	232.0042	242.7627	363.0730	463.8191	466.8573	456.2276	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	912.9840	894.2923	817.0040	685.6949	526.9566	353.0675	233.6013	245.1783	382.3979	579.2731	759.8033	908.3084	(97)
Space heating kWh	322.8111	225.7405	165.5433	76.9899	27.9646	0.0000	0.0000	0.0000	0.0000	85.8978	210.9211	336.3481	(98a)
Space heating requirement - total per year (kWh/year)												1452.2164	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	322.8111	225.7405	165.5433	76.9899	27.9646	0.0000	0.0000	0.0000	0.0000	85.8978	210.9211	336.3481	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1452.2164	
Space heating per m2											(98c) / (4) =	29.0443	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	322.8111	225.7405	165.5433	76.9899	27.9646	0.0000	0.0000	0.0000	0.0000	85.8978	210.9211	336.3481	(98)
Space heating efficiency (main heating system 1)	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)	388.9291	271.9765	199.4497	92.7589	33.6923	0.0000	0.0000	0.0000	0.0000	103.4913	254.1218	405.2387	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	190.1389	168.3256	179.6202	160.2291	156.7898	142.3134	140.9852	147.2650	147.9646	162.9993	170.8103	188.4021	(64)
Efficiency of water heater												79.4000	(216)
(217)m	84.6033	84.1087	83.3046	82.0009	80.5921	79.4000	79.4000	79.4000	79.4000	82.1714	83.9322	84.7060	(217)
Fuel for water heating, kWh/month	224.7417	200.1288	215.6188	195.3993	194.5473	179.2360	177.5632	185.4722	186.3534	198.3650	203.5099	222.4189	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	17.4563	14.0041	12.6091	9.2380	7.1357	5.8299	6.5094	8.4612	10.9902	14.4198	16.2871	17.9414	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.5641	-16.3876	-26.0230	-32.1418	-37.0159	-35.4266	-34.9499	-31.7579	-26.4694	-19.8878	-12.0907	-8.9413	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.1011	-7.0388	-15.2600	-24.7564	-34.3162	-35.0494	-34.4548	-28.2511	-19.4792	-10.4625	-4.2476	-2.4034	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1749.6583	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2383.3546	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	53.3000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	98.3000	(231)
Electricity for lighting (calculated in Appendix L)	140.8820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-510.4766	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3861.7182	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1749.6583	0.2100	367.4282	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2383.3546	0.2100	500.5045	(264)
Space and water heating			867.9327	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	140.8820	0.1443	20.3336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-291.6560	0.1327	-38.7125	
PV Unit electricity exported	-218.8206	0.1239	-27.1205	
Total			-65.8330	(269)
Total CO2, kg/year			836.0687	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.7200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1749.6583	1.1300	1977.1139	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2383.3546	1.1300	2693.1907	(278)
Space and water heating			4670.3045	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	140.8820	1.5338	216.0894	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-291.6560	1.4905	-434.7004	
PV Unit electricity exported	-218.8206	0.4549	-99.5310	
Total			-534.2314	(283)
Total Primary energy kWh/year			4500.8708	(286)
Dwelling Primary energy Rate (DPER)			90.0200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)

TER Opening Type			10.1500	1.1450	11.6221		(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364		(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796		(29a)
Total net area of external elements Aum(A, m2)			58.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.2781		(33)
Main dwelling							
Party Wall 1			15.3900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	191.4460	(35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9293	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	28.2074	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	55.3444	55.1236	54.9071	53.8904	53.7002	52.8147	52.8147	52.6507	53.1558	53.7002	54.0850	54.4873	(39)
Average = Sum(39)m / 12 =												53.8895	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1069	1.1025	1.0981	1.0778	1.0740	1.0563	1.0563	1.0530	1.0631	1.0740	1.0817	1.0897	(40)
HLP (average)												1.0778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6901	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
										Total per year (kWh/year) = Sum(64)m =		1992.9475	(64)
12Total per year (kWh/year)												1993	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557	(72)
Total internal gains	366.2732	373.8444	358.2220	343.8889	325.4004	309.2388	296.7585	298.3915	308.3807	323.6261	344.5705	358.7198	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7800	19.6403	0.6300	0.7000	0.7700	34.6934	(76)

South			3.7000		46.7521		0.6300		0.7000		0.7700		52.8657 (78)
West			0.6700		19.6403		0.6300		0.7000		0.7700		4.0216 (80)
Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	457.8540	536.1596	593.2344	650.4414	678.2217	662.4500	636.1575	603.6283	568.6491	506.8768	455.5074	436.2380	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0441	48.2366	48.4267	49.3404	49.5151	50.3453	50.3453	50.5021	50.0223	49.5151	49.1628	48.7999	
alpha	4.2029	4.2158	4.2284	4.2894	4.3010	4.3564	4.3564	4.3668	4.3348	4.3010	4.2775	4.2533	
util living area	0.9729	0.9490	0.9064	0.8120	0.6715	0.4965	0.3624	0.3967	0.6071	0.8485	0.9502	0.9772	(86)
MIT	19.7280	19.9930	20.3121	20.6685	20.8823	20.9756	20.9950	20.9927	20.9422	20.6563	20.1478	19.6955	(87)
Th 2	19.9952	19.9988	20.0024	20.0190	20.0221	20.0367	20.0367	20.0394	20.0311	20.0221	20.0158	20.0092	(88)
util rest of house	0.9668	0.9380	0.8869	0.7763	0.6170	0.4269	0.2845	0.3160	0.5344	0.8106	0.9376	0.9719	(89)
MIT 2	18.5429	18.8748	19.2671	19.6954	19.9244	20.0218	20.0348	20.0364	19.9919	19.6956	19.0851	18.5122	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	19.1592	19.4563	19.8105	20.2014	20.4225	20.5178	20.5341	20.5337	20.4861	20.1951	19.6377	19.1275	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1592	19.4563	19.8105	20.2014	20.4225	20.5178	20.5341	20.5337	20.4861	20.1951	19.6377	19.1275	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9603	0.9309	0.8826	0.7834	0.6400	0.4622	0.3249	0.3579	0.5695	0.8180	0.9318	0.9659	(94)
Useful gains	439.6766	499.1278	523.6068	509.5275	434.0850	306.1732	206.7081	216.0161	323.8422	414.6006	424.4402	421.3812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	822.3718	802.3943	730.8413	609.0395	468.3983	312.5461	207.7794	217.6406	339.4556	515.2610	678.1017	813.3609	(97)
Space heating kWh	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98a)
Space heating requirement - total per year (kWh/year)												1289.0410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1289.0410	
Space heating per m2											(98c) / (4) =	25.7808	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	308.1442	220.5575	166.8642	77.5418	27.6288	0.0000	0.0000	0.0000	0.0000	81.0512	197.6583	315.6200	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.1725	84.7186	83.9856	82.7347	81.3945	80.3000	80.3000	80.3000	80.3000	82.7822	84.4599	85.2437	(217)
Fuel for water heating, kWh/month	230.9921	205.6197	221.1071	198.0806	194.2729	176.4186	174.0932	182.2506	185.3789	201.4076	208.4800	228.5465	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1395.0661	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2406.6478	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3601.0410	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1395.0661	0.2100	292.9639	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2406.6478	0.2100	505.3960	(264)
Space and water heating			798.3599	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			774.8498	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.5000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1395.0661	1.1300	1576.4247	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2406.6478	1.1300	2719.5120	(278)
Space and water heating			4295.9367	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4170.7442	(286)
Target Primary Energy Rate (TPER)			83.4100	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 3	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	82 B	**DER**	18.91	**TER**	17.71
Environmental	89 B	**% DER < TER**			-6.78
CO_2 Emissions (t/year)	0.64	**DFEE**	37.83	**TFEE**	34.69
Compliance Check	See BREL	**% DFEE < TFEE**			-9.05
% DPER < TPER	-6.66	**DPER**	102.09	**TPER**	95.72

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000	(1b)	x 2.6000	(2b) =	101.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	101.4000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1972 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4472 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4472 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5702	0.5590	0.5479	0.4920	0.4808	0.4249	0.4249	0.4137	0.4472	0.4808	0.5031	0.5255	(22b)
Effective ac	0.6626	0.6563	0.6501	0.6210	0.6156	0.5903	0.5903	0.5856	0.6000	0.6156	0.6266	0.6381	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			7.6400	1.1450	8.7481			(27)
EXTERNAL	36.0400	9.9800	26.0600	0.1800	4.6908	70.0000	1824.2000	(29a)
HALLWAY	8.2200		8.2200	0.1700	1.3974	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.6443			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			39.0000			40.0000	1560.0000	(32d)
Party Ceiling 1			39.0000			30.0000	1170.0000	(32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		8958.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							229.6974	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.3000	1.7400
E3 Sill	4.8000	0.0400	0.1920
E4 Jamb	13.3400	0.0500	0.6670
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828
E16 Corner (normal)	5.2000	0.0900	0.4680

E18 Party wall between dwellings									2.6000	0.0600	0.1560		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)									16.3600	0.0000	0.0000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												5.6058	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		23.2501	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.1713	21.9600	21.7530	20.7804	20.5984	19.7513	19.7513	19.5944	20.0776	20.5984	20.9665	21.3514	(38)
Heat transfer coeff	45.4214	45.2101	45.0030	44.0304	43.8485	43.0014	43.0014	42.8445	43.3277	43.8485	44.2166	44.6015	(39)
Average = Sum(39)m / 12 =												44.0296	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1647	1.1592	1.1539	1.1290	1.1243	1.1026	1.1026	1.0986	1.1110	1.1243	1.1338	1.1436	(40)
HLP (average)												1.1290	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3800	(42)
Hot water usage for mixer showers	53.2775	52.4768	51.3101	49.0778	47.4304	45.5933	44.5491	45.7069	46.9762	48.9487	51.2290	53.0734	(42a)
Hot water usage for baths	21.5670	21.2467	20.7956	19.9640	19.3412	18.6507	18.2777	18.7256	19.2133	19.9522	20.8010	21.4941	(42b)
Hot water usage for other uses	30.2766	29.1756	28.0747	26.9737	25.8727	24.7718	24.7718	25.8727	26.9737	28.0747	29.1756	30.2766	(42c)
Average daily hot water use (litres/day)												96.6402	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.1211	102.8991	100.1804	96.0155	92.6444	89.0158	87.5986	90.3053	93.1632	96.9756	101.2056	104.8440	(44)
Energy conte	166.4861	146.5270	153.9735	131.4404	124.7172	109.4553	105.9429	111.8168	114.8796	131.5949	144.1859	164.1604	(45)
Energy content (annual)										Total = Sum(45)m =		1605.1799	
Distribution loss (46)m = 0.15 x (45)m	24.9729	21.9790	23.0960	19.7161	18.7076	16.4183	15.8914	16.7725	17.2319	19.7392	21.6279	24.6241	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	47.3501	47.2106	43.8982	44.6393	46.0186	45.9435	49.4177	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	217.4450	192.5544	204.9324	178.7905	171.9277	153.3535	150.5821	157.8354	160.8231	181.0126	193.5010	215.1193	(62)
WWHRS	-41.0809	-36.3323	-38.0450	-31.5028	-29.3595	-25.1231	-23.5489	-25.0419	-25.9933	-30.6433	-34.7151	-40.3201	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	176.3641	156.2221	166.8874	147.2877	142.5683	128.2304	127.0332	132.7935	134.8297	150.3694	158.7858	174.7992	(64)
										Total per year (kWh/year) = Sum(64)m =		1796.1709	(64)
12Total per year (kWh/year)												1796	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	68.0963	60.2271	63.9359	55.5415	53.2711	47.3684	46.3858	48.6837	49.6833	56.1097	60.2706	67.3231	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.8268	68.4511	61.8268	63.8877	61.8268	63.8877	61.8268	61.8268	63.8877	61.8268	63.8877	61.8268	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	91.5273	89.6236	85.9354	77.1409	71.6009	65.7895	62.3465	65.4351	69.0046	75.4163	83.7091	90.4880	(72)
Total internal gains	319.0813	325.0370	311.6120	298.2523	282.2872	267.6754	256.9198	258.7733	267.5161	281.4930	300.2110	312.7902	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains	41.4903	81.1639	133.6653	194.9429	238.9099	244.5668	232.8375	200.0040	155.4583	96.3078	51.7336	34.1196	(83)
Total gains	360.5716	406.2009	445.2773	493.1952	521.1971	512.2422	489.7573	458.7773	422.9744	377.8008	351.9445	346.9098	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.7845	55.0405	55.2938	56.5152	56.7497	57.8677	57.8677	58.0795	57.4319	56.7497	56.2773	55.7917
alpha	4.6523	4.6694	4.6863	4.7677	4.7833	4.8578	4.8578	4.8720	4.8288	4.7833	4.7518	4.7194

util living area													
	0.9833	0.9699	0.9402	0.8569	0.7130	0.5248	0.3840	0.4256	0.6621	0.8949	0.9685	0.9856	(86)
MIT	19.8167	20.0210	20.3135	20.6751	20.8932	20.9810	20.9966	20.9945	20.9440	20.6518	20.1934	19.8020	(87)
Th 2	19.9484	19.9528	19.9570	19.9772	19.9810	19.9987	19.9987	20.0020	19.9919	19.9810	19.9734	19.9654	(88)
util rest of house													
	0.9786	0.9617	0.9242	0.8220	0.6539	0.4479	0.2978	0.3353	0.5815	0.8603	0.9585	0.9816	(89)
MIT 2	18.9001	19.1028	19.3873	19.7344	19.9152	19.9906	19.9979	20.0005	19.9643	19.7262	19.2902	18.8989	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	19.5817	19.7856	20.0761	20.4339	20.6424	20.7271	20.7405	20.7396	20.6928	20.4145	19.9618	19.5704	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5817	19.7856	20.0761	20.4339	20.6424	20.7271	20.7405	20.7396	20.6928	20.4145	19.9618	19.5704	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9766	0.9602	0.9262	0.8385	0.6932	0.5043	0.3618	0.4023	0.6387	0.8762	0.9584	0.9797	(94)
Useful gains	352.1332	390.0337	412.4183	413.5398	361.2680	258.3046	177.2145	184.5659	270.1441	331.0374	337.3020	339.8834	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	694.1155	672.9780	610.9642	507.8441	392.1102	263.4727	178.0476	185.9299	285.6511	430.3502	568.7046	685.5433	(97)
Space heating kWh													
	254.4348	190.1386	147.7181	67.8991	22.9466	0.0000	0.0000	0.0000	0.0000	73.8887	166.6099	257.1710	(98a)
Space heating requirement - total per year (kWh/year)												1180.8068	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	254.4348	190.1386	147.7181	67.8991	22.9466	0.0000	0.0000	0.0000	0.0000	73.8887	166.6099	257.1710	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1180.8068	
Space heating per m2											(98c) / (4) =	30.2771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	254.4348	190.1386	147.7181	67.8991	22.9466	0.0000	0.0000	0.0000	0.0000	73.8887	166.6099	257.1710	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	306.5480	229.0826	177.9736	81.8062	27.6465	0.0000	0.0000	0.0000	0.0000	89.0225	200.7348	309.8445	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	176.3641	156.2221	166.8874	147.2877	142.5683	128.2304	127.0332	132.7935	134.8297	150.3694	158.7858	174.7992	(64)
Efficiency of water heater												79.4000	(216)
(217)m	84.2636	83.9012	83.2186	81.9263	80.4905	79.4000	79.4000	79.4000	79.4000	82.0417	83.5823	84.3050	(217)
Fuel for water heating, kWh/month													
	209.3005	186.1978	200.5410	179.7807	177.1242	161.4992	159.9915	167.2463	169.8107	183.2841	189.9754	207.3415	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	13.4326	10.7761	9.7027	7.1086	5.4909	4.4861	5.0090	6.5109	8.4570	11.0960	12.5329	13.8059	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.2450	-12.8312	-20.4493	-25.3625	-29.3152	-28.1084	-27.7384	-25.1547	-20.8901	-15.6169	-9.4522	-6.9746	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3346	-5.3053	-11.5117	-18.6878	-25.9098	-26.4536	-25.9943	-21.3039	-14.6830	-7.8802	-3.1967	-1.8084	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1422.6588	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.4000	
Water heating fuel used												2192.0928	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												53.3000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												98.3000	(231)
Electricity for lighting (calculated in Appendix L)												108.4087	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-395.2077	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3426.2526	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1422.6588	0.2100	298.7583	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2192.0928	0.2100	460.3395	(264)
Space and water heating			759.0978	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	108.4087	0.1443	15.6467	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-230.1384	0.1327	-30.5280	
PV Unit electricity exported	-165.0693	0.1239	-20.4576	
Total			-50.9857	(269)
Total CO2, kg/year			737.3943	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			18.9100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1422.6588	1.1300	1607.6044	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2192.0928	1.1300	2477.0649	(278)
Space and water heating			4084.6693	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	108.4087	1.5338	166.2809	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-230.1384	1.4901	-342.9396	
PV Unit electricity exported	-165.0693	0.4548	-75.0787	
Total			-418.0184	(283)
Total Primary energy kWh/year			3981.6400	(286)
Dwelling Primary energy Rate (DPER)			102.0900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000	(1b)	x 2.6000	(2b) =	101.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		101.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1972	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4472	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4472	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5702	0.5590	0.5479	0.4920	0.4808	0.4249	0.4249	0.4137	0.4472	0.4808	0.5031	0.5255	(22b)
Effective ac	0.6626	0.6563	0.6501	0.6210	0.6156	0.5903	0.5903	0.5856	0.6000	0.6156	0.6266	0.6381	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			7.4100	1.1450	8.4847			(27)

EXTERNAL	36.0400	9.7500	26.2900	0.1800	4.7322	(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796	(29a)
Total net area of external elements Aum(A, m2)			44.2600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.0365	(33)
Main dwelling						
Party Wall 1			21.2700	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 239.6974 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900
E3 Sill	4.8000	0.0500	0.2400
E4 Jamb	13.3400	0.0500	0.6670
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	2.6000	0.0600	0.1560
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.2038 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 21.2403 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.1713	21.9600	21.7530	20.7804	20.5984	19.7513	19.7513	19.5944	20.0776	20.5984	20.9665	21.3514	(38)
Heat transfer coeff	43.4116	43.2004	42.9933	42.0207	41.8387	40.9916	40.9916	40.8347	41.3179	41.8387	42.2068	42.5917	(39)
Average = Sum(39)m / 12 =												42.0198	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1131	1.1077	1.1024	1.0775	1.0728	1.0511	1.0511	1.0470	1.0594	1.0728	1.0822	1.0921	(40)
HLP (average)												1.0774	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3800 (42)

Hot water usage for mixer showers

47.3578	46.6461	45.6090	43.6247	42.1604	40.5274	39.5992	40.6284	41.7566	43.5100	45.5369	47.1763	(42a)

Hot water usage for baths

20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)

Hot water usage for other uses

28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)

Average daily hot water use (litres/day) 88.8064 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.6092	94.5473	92.0358	88.2155	85.1137	81.7787	80.4962	82.9968	85.6343	89.1355	93.0146	96.3584	(44)
Energy conte	153.0053	134.6340	141.4555	120.7626	114.5793	100.5565	97.3532	102.7674	105.5956	120.9560	132.5164	150.8740	(45)
Energy content (annual)										Total = Sum(45)m =		1475.0560	
Distribution loss (46)m = 0.15 x (45)m	22.9508	20.1951	21.2183	18.1144	17.1869	15.0835	14.6030	15.4151	15.8393	18.1434	19.8775	22.6311	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	49.2310	43.5176	46.9004	43.5035	43.3730	40.3292	41.0200	42.2943	42.2306	45.4225	45.8702	49.1032	(61)
Total heat required for water heating calculated for each month	202.2362	178.1517	188.3559	164.2662	157.9523	140.8857	138.3732	145.0617	147.8262	166.3785	178.3866	199.9772	(62)
WWHRS	-21.6500	-19.1474	-20.0501	-16.6023	-15.4727	-13.2401	-12.4105	-13.1973	-13.6987	-16.1493	-18.2952	-21.2491	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	180.5863	159.0042	168.3059	147.6639	142.4796	127.6456	125.9627	131.8644	134.1275	150.2292	160.0914	178.7282	(64)
										Total per year (kWh/year) = Sum(64)m =		1806.6889	(64)
12Total per year (kWh/year)												1807	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	63.1820	55.6452	58.7591	51.0295	48.9409	43.5173	42.6249	44.7437	45.6682	51.5735	55.5293	62.4414	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.8308	67.3484	60.8308	62.8585	60.8308	62.8585	60.8308	60.8308	62.8585	60.8308	62.8585	60.8308	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	84.9220	82.8054	78.9772	70.8742	65.7807	60.4408	57.2916	60.1394	63.4281	69.3192	77.1240	83.9266	(72)
Total internal gains	311.4800	317.1160	303.6578	290.9564	275.4710	261.2974	250.8688	252.4815	260.9103	274.3999	292.5966	305.2328	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.7100	19.6403	0.6300	0.7000	0.7700	40.2756	(76)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	44.4772	87.0068	143.2878	208.9768	256.1089	262.1730	249.5994	214.4022	166.6497	103.2409	55.4578	36.5759	(83)
Total gains	355.9571	404.1228	446.9456	499.9332	531.5798	523.4704	500.4682	466.8837	427.5600	377.6408	348.0544	341.8086	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8163	60.1088	60.3983	61.7963	62.0651	63.3476	63.3476	63.5910	62.8474	62.0651	61.5237	60.9678	
alpha	4.9878	5.0073	5.0266	5.1198	5.1377	5.2232	5.2232	5.2394	5.1898	5.1377	5.1016	5.0645	
util living area													
	0.9851	0.9713	0.9386	0.8436	0.6857	0.4943	0.3593	0.4003	0.6373	0.8902	0.9704	0.9875	(86)
MIT	19.9291	20.1322	20.4154	20.7502	20.9290	20.9896	20.9984	20.9972	20.9635	20.7147	20.2836	19.9141	(87)
Th 2	20.4434	20.4461	20.4488	20.4613	20.4636	20.4745	20.4745	20.4765	20.4703	20.4636	20.4589	20.4540	(88)
util rest of house													
	0.9829	0.9671	0.9300	0.8244	0.6544	0.4557	0.3168	0.3555	0.5955	0.8718	0.9655	0.9856	(89)
MIT 2	19.4394	19.6421	19.9211	20.2490	20.4094	20.4679	20.4737	20.4751	20.4455	20.2230	19.8033	19.4331	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	19.8035	20.0065	20.2887	20.6217	20.7958	20.8558	20.8638	20.8633	20.8307	20.5886	20.1605	19.7908	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8035	20.0065	20.2887	20.6217	20.7958	20.8558	20.8638	20.8633	20.8307	20.5886	20.1605	19.7908	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9799	0.9634	0.9272	0.8303	0.6740	0.4838	0.3483	0.3886	0.6242	0.8764	0.9624	0.9829	(94)
Useful gains	348.8055	389.3291	414.4291	415.1003	358.2754	253.2515	174.3139	181.4532	266.8856	330.9488	334.9767	335.9620	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	673.0329	652.6059	592.8209	492.5540	380.5561	256.4363	174.7818	182.2597	278.0978	417.9115	551.2421	664.0384	(97)
Space heating kWh													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98a)
Space heating requirement - total per year (kWh/year)												1087.7143	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1087.7143	
Space heating per m2											(98c) / (4) =	27.8901	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	261.0662	191.4740	143.6402	60.3535	17.9403	0.0000	0.0000	0.0000	0.0000	70.0219	168.5185	264.1654	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5863	159.0042	168.3059	147.6639	142.4796	127.6456	125.9627	131.8644	134.1275	150.2292	160.0914	178.7282	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.0025	84.6108	83.8775	82.4875	81.1178	80.3000	80.3000	80.3000	80.3000	82.7086	84.3220	85.0497	(217)
Fuel for water heating, kWh/month													
	212.4481	187.9242	200.6567	179.0137	175.6452	158.9609	156.8651	164.2147	167.0330	181.6368	189.8573	210.1456	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	12.6394	10.1398	9.1298	6.6889	5.1667	4.2212	4.7132	6.1264	7.9576	10.4408	11.7929	12.9907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.5051	-11.4259	-17.7250	-21.5712	-24.7560	-23.6831	-23.4153	-21.3606	-18.0067	-13.7752	-8.5514	-6.3952	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0121	-4.3759	-8.9665	-13.8670	-18.7247	-18.9396	-18.6975	-15.6360	-11.2211	-6.3662	-2.7219	-1.5795	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1177.1799	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2184.4014	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	102.0075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-321.2788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3228.3100	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1177.1799	0.2100	247.2078	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2184.4014	0.2100	458.7243	(264)
Space and water heating			705.9321	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	102.0075	0.1443	14.7228	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	0.1330	-26.3533	
PV Unit electricity exported	-123.1080	0.1251	-15.3980	
Total			-41.7513	(269)
Total CO2, kg/year			690.8329	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.7100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1177.1799	1.1300	1330.2133	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2184.4014	1.1300	2468.3736	(278)
Space and water heating			3798.5869	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	102.0075	1.5338	156.4624	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	1.4914	-295.5498	
PV Unit electricity exported	-123.1080	0.4591	-56.5166	
Total			-352.0664	(283)
Total Primary energy kWh/year			3733.0837	(286)
Target Primary Energy Rate (TPER)			95.7200	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 4	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	13.32	**TER**	12.15
Environmental	89 B	**% DER < TER**			-9.63
CO_2 Emissions (t/year)	0.98	**DFEE**	35.00	**TFEE**	31.13
Compliance Check	See BREL	**% DFEE < TFEE**			-12.41
% DPER < TPER	-10.08	**DPER**	71.38	**TPER**	64.84

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	87.0000	(1b)	x 2.6000	(2b) =	226.2000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	226.2000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0884 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3384 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3384 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4315	0.4230	0.4146	0.3723	0.3638	0.3215	0.3215	0.3130	0.3384	0.3638	0.3807	0.3976	(22b)
Effective ac	0.5931	0.5895	0.5859	0.5693	0.5662	0.5517	0.5517	0.5490	0.5573	0.5662	0.5725	0.5791	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			25.5000	1.1450	29.1985			(27)
EXTERNAL	86.2100	27.8400	58.3700	0.1800	10.5066	70.0000	4085.9000	(29a)
External Roof 1	6.3100		6.3100	0.1100	0.6941	9.0000	56.7900	(30)
Total net area of external elements Aum(A, m2)			92.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.2072			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			87.0000			40.0000	3480.0000	(32d)
Party Ceiling 1			80.6900			30.0000	2420.7000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13871.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.4482 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.3000	3.6780
E3 Sill	4.8000	0.0400	0.1920
E4 Jamb	27.9200	0.0500	1.3960
E7 Party floor between dwellings (in blocks of flats)	58.6100	0.0700	4.1027
E16 Corner (normal)	10.4000	0.0900	0.9360

E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	
E14 Flat roof	7.7100	0.0400	0.3084	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9251 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.1323 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.2717	44.0019	43.7374	42.4951	42.2627	41.1807	41.1807	40.9803	41.5975	42.2627	42.7329	43.2244	(38)
Heat transfer coeff	98.4039	98.1341	97.8696	96.6274	96.3950	95.3130	95.3130	95.1126	95.7297	96.3950	96.8651	97.3567	(39)

Average = Sum(39)m / 12 = 96.6263

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1311	1.1280	1.1249	1.1107	1.1080	1.0956	1.0956	1.0932	1.1003	1.1080	1.1134	1.1190	(40)
HLP (average)												1.1106	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5824 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
75.9577	74.8162	73.1528	69.9702	67.6216	65.0023	63.5136	65.1644	66.9740	69.7862	73.0371	75.6667	(42a)

Hot water usage for baths

30.6928	30.2370	29.5951	28.4115	27.5253	26.5426	26.0118	26.6492	27.3432	28.3947	29.6027	30.5890	(42b)

Hot water usage for other uses

43.2382	41.6659	40.0936	38.5213	36.9490	35.3767	35.3767	36.9490	38.5213	40.0936	41.6659	43.2382	(42c)

Average daily hot water use (litres/day) 137.7949 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.8887	146.7190	142.8414	136.9030	132.0958	126.9216	124.9020	128.7625	132.8384	138.2745	144.3057	149.4939	(44)
Energy conte	237.3870	208.9259	219.5420	187.4134	177.8263	156.0649	151.0582	159.4349	163.8031	187.6372	205.5899	234.0713	(45)
Energy content (annual)										Total = Sum(45)m =		2288.7540	
Distribution loss (46)m = 0.15 x (45)m	35.6080	31.3389	32.9313	28.1120	26.6740	23.4097	22.6587	23.9152	24.5705	28.1456	30.8385	35.1107	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.3459	254.9533	270.5009	236.7284	228.7852	205.3800	202.0171	210.3938	213.1182	238.5961	254.9050	285.0302	(62)
WWHRS	-58.5690	-51.7989	-54.2408	-44.9135	-41.8578	-35.8180	-33.5737	-35.7022	-37.0587	-43.6881	-49.4933	-57.4844	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	229.7769	203.1545	216.2601	191.8149	186.9274	169.5620	168.4434	174.6916	176.0595	194.9080	205.4116	227.5458	(64)
										Total per year (kWh/year) = Sum(64)m =		2344.5557	(64)
12Total per year (kWh/year)												2345	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	91.6709	80.9747	85.7374	74.6437	71.8670	64.2203	62.9666	65.7518	66.7933	75.1291	80.6874	90.5684	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.7482	130.3641	117.7482	121.6731	117.7482	121.6731	117.7482	117.7482	121.6731	117.7482	121.6731	117.7482	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.4490	235.8715	229.7669	216.7711	200.3661	184.9478	174.6474	172.2249	178.3295	191.3253	207.7303	223.1486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	(71)
Water heating gains (Table 5)	123.2136	120.4981	115.2385	103.6718	96.5954	89.1949	84.6325	88.3761	92.7685	100.9800	112.0658	121.7317	(72)
Total internal gains	539.1466	551.4695	527.4895	506.8519	479.4456	457.5517	438.7640	440.0851	454.5070	474.7894	506.2051	527.3644	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	10.3800	19.6403	0.5700	0.7000	0.7700	56.3704	(76)
South	9.9000	46.7521	0.5700	0.7000	0.7700	127.9800	(78)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains	201.4914	352.8046	504.1560	653.9998	754.5250	757.4660	726.8775	651.4412	556.4242	396.0935	243.1846	171.1882	(83)
Total gains	740.6380	904.2741	1031.6455	1160.8517	1233.9706	1215.0178	1165.6415	1091.5263	1010.9311	870.8828	749.3898	698.5526	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.1583	39.2660	39.3721	39.8782	39.9744	40.4282	40.4282	40.5134	40.2522	39.9744	39.7804	39.5795	
alpha	3.6106	3.6177	3.6248	3.6585	3.6650	3.6952	3.6952	3.7009	3.6835	3.6650	3.6520	3.6386	
util living area													
	0.9683	0.9385	0.8885	0.7881	0.6470	0.4817	0.3545	0.3926	0.5987	0.8372	0.9442	0.9736	(86)
MIT	19.3931	19.7303	20.1269	20.5565	20.8288	20.9566	20.9892	20.9842	20.9033	20.5228	19.8866	19.3372	(87)
Th 2	19.9755	19.9780	19.9805	19.9921	19.9943	20.0045	20.0045	20.0064	20.0006	19.9943	19.9899	19.9853	(88)
util rest of house													
	0.9619	0.9270	0.8684	0.7530	0.5944	0.4135	0.2766	0.3113	0.5278	0.8007	0.9317	0.9682	(89)
MIT 2	18.5354	18.8644	19.2447	19.6473	19.8789	19.9823	20.0008	20.0006	19.9459	19.6309	19.0307	18.4879	(90)
Living area fraction									fLA = Living area / (4) =			0.3333	(91)
MIT	18.8213	19.1530	19.5388	19.9504	20.1955	20.3071	20.3303	20.3285	20.2650	19.9282	19.3160	18.7710	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8213	19.1530	19.5388	19.9504	20.1955	20.3071	20.3303	20.3285	20.2650	19.9282	19.3160	18.7710	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9528	0.9158	0.8584	0.7514	0.6054	0.4347	0.3024	0.3380	0.5474	0.7980	0.9215	0.9599	(94)
Useful gains	705.6930	828.1391	885.5939	872.2397	747.0066	528.1748	352.4597	368.9693	553.3888	694.9808	690.5420	670.5754	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1428.9560	1398.7092	1276.1026	1067.7683	818.9280	543.9560	355.5429	373.6496	590.1782	899.1902	1183.3023	1418.5827	(97)
Space heating kWh													
	538.1076	383.4231	290.5385	140.7806	53.5096	0.0000	0.0000	0.0000	0.0000	151.9318	354.7875	556.5174	(98a)
Space heating requirement - total per year (kWh/year)												2469.5962	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	538.1076	383.4231	290.5385	140.7806	53.5096	0.0000	0.0000	0.0000	0.0000	151.9318	354.7875	556.5174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2469.5962	
Space heating per m2											(98c) / (4) =	28.3862	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	538.1076	383.4231	290.5385	140.7806	53.5096	0.0000	0.0000	0.0000	0.0000	151.9318	354.7875	556.5174	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	648.3225	461.9556	350.0464	169.6152	64.4693	0.0000	0.0000	0.0000	0.0000	183.0504	427.4548	670.5029	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	229.7769	203.1545	216.2601	191.8149	186.9274	169.5620	168.4434	174.6916	176.0595	194.9080	205.4116	227.5458	(64)
Efficiency of water heater												79.4000	(216)
(217)m	85.2374	84.8182	84.1124	82.8262	81.1653	79.4000	79.4000	79.4000	79.4000	82.9511	84.6385	85.3181	(217)
Fuel for water heating, kWh/month													
	269.5729	239.5174	257.1084	231.5873	230.3047	213.5541	212.1454	220.0146	221.7374	234.9675	242.6928	266.7028	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	30.8382	24.7396	22.2753	16.3198	12.6059	10.2991	11.4995	14.9475	19.4153	25.4740	28.7728	31.6953	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.1748	-28.6943	-43.7309	-52.2098	-58.9710	-56.0150	-55.3482	-50.9447	-43.6199	-34.1532	-21.6685	-16.3907	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-6.2839	-13.5755	-27.6690	-42.5874	-57.3400	-58.0006	-57.3035	-48.0211	-34.5644	-19.7251	-8.4876	-4.9417	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2975.4171	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2839.9051	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	53.3000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	98.3000	(231)
Electricity for lighting (calculated in Appendix L)	248.8823	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-859.4208	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)

Energy used	0.0000	(237)
Total delivered energy for all uses	5303.0838	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2975.4171	0.2100	624.8376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2839.9051	0.2100	596.3801	(264)
Space and water heating			1221.2177	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	248.8823	0.1443	35.9214	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-480.9209	0.1334	-64.1389	
PV Unit electricity exported	-378.4998	0.1252	-47.3838	
Total			-111.5227	(269)
Total CO2, kg/year			1159.2518	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.3200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2975.4171	1.1300	3362.2213	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2839.9051	1.1300	3209.0928	(278)
Space and water heating			6571.3141	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	248.8823	1.5338	381.7440	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-480.9209	1.4928	-717.9342	
PV Unit electricity exported	-378.4998	0.4595	-173.9181	
Total			-891.8523	(283)
Total Primary energy kWh/year			6209.9140	(286)
Dwelling Primary energy Rate (DPER)			71.3800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	87.0000	(1b) x	2.6000	(2b) =	226.2000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		226.2000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1326	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3826	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4878	0.4783	0.4687	0.4209	0.4113	0.3635	0.3635	0.3539	0.3826	0.4113	0.4305	0.4496	(22b)
Effective ac	0.6190	0.6144	0.6098	0.5886	0.5846	0.5661	0.5661	0.5626	0.5732	0.5846	0.5926	0.6011	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			19.4200	1.1450	22.2366			(27)
EXTERNAL	86.2100	21.7600	64.4500	0.1800	11.6010			(29a)
External Roof 1	6.3100		6.3100	0.1100	0.6941			(30)
Total net area of external elements Aum(A, m2)			92.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.8717			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 168.7229 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	4.8000	0.0500	0.2400
E4 Jamb	27.9200	0.0500	1.3960
E7 Party floor between dwellings (in blocks of flats)	58.6100	0.0700	4.1027
E16 Corner (normal)	10.4000	0.0900	0.9360
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000
E14 Flat roof	7.7100	0.0800	0.6168

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.2165 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.0882 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.2057	45.8608	45.5227	43.9347	43.6376	42.2544	42.2544	41.9983	42.7872	43.6376	44.2386	44.8670	(38)
Heat transfer coeff	91.2940	90.9490	90.6109	89.0229	88.7258	87.3427	87.3427	87.0865	87.8754	88.7258	89.3269	89.9552	(39)
Average = Sum(39)m / 12 =												89.0215	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0494	1.0454	1.0415	1.0233	1.0198	1.0039	1.0039	1.0010	1.0101	1.0198	1.0267	1.0340	(40)
HLP (average)												1.0232	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5824 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
67.5179	66.5033	65.0247	62.1958	60.1080	57.7799	56.4565	57.9239	59.5324	62.0322	64.9219	67.2593	(42a)

Hot water usage for baths

29.1581	28.7251	28.1153	26.9909	26.1490	25.2154	24.7112	25.3167	25.9760	26.9750	28.1225	29.0596	(42b)

Hot water usage for other uses

41.0763	39.5826	38.0889	36.5952	35.1015	33.6079	33.6079	35.1015	36.5952	38.0889	39.5826	41.0763	(42c)

Average daily hot water use (litres/day) 126.6255 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.7524	134.8110	131.2289	125.7819	121.3586	116.6032	114.7755	118.3421	122.1037	127.0961	132.6270	137.3951	(44)
Energy conte	218.1661	191.9690	201.6940	172.1891	163.3720	143.3772	138.8111	146.5323	150.5660	172.4682	188.9515	215.1275	(45)
Energy content (annual)										Total = Sum(45)m =		2103.2239	
Distribution loss (46)m = 0.15 x (45)m	32.7249	28.7954	30.2541	25.8284	24.5058	21.5066	20.8217	21.9798	22.5849	25.8702	28.3427	32.2691	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	269.1250	237.9964	252.6529	221.5042	214.3309	192.6922	189.7700	197.4912	199.8811	223.4271	238.2666	266.0864	(62)
WWHRS	-30.8664	-27.2985	-28.5854	-23.6698	-22.0594	-18.8764	-17.6936	-18.8154	-19.5303	-23.0240	-26.0834	-30.2948	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	238.2586	210.6979	224.0675	197.8344	192.2714	173.8158	172.0763	178.6758	180.3508	200.4030	212.1831	235.7916	(64)
										Total per year (kWh/year) = Sum(64)m =		2416.4264	(64)
12Total per year (kWh/year)												2416	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	85.2799	75.3366	79.8030	69.5817	67.0609	60.0017	58.8944	61.4617	62.3920	70.0854	75.1551	84.2696	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.7455	130.3611	117.7455	121.6704	117.7455	121.6704	117.7455	117.7455	121.6704	117.7455	121.6704	117.7455	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.4490	235.8715	229.7669	216.7711	200.3661	184.9478	174.6474	172.2249	178.3295	191.3253	207.7303	223.1486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	(71)
Water heating gains (Table 5)	114.6236	112.1080	107.2621	96.6412	90.1356	83.3357	79.1592	82.6098	86.6555	94.2008	104.3821	113.2656	(72)
Total internal gains	530.5540	543.0764	519.5104	499.8185	472.9832	451.6897	433.2880	434.3162	448.3913	468.0075	498.5187	518.8956	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

		W/m2	or Table 6b	or Table 6c	Table 6d		
North		3.4300	10.6334	0.6300	0.7000	0.7700	11.1465 (74)
East		7.9000	19.6403	0.6300	0.7000	0.7700	47.4183 (76)
South		7.5400	46.7521	0.6300	0.7000	0.7700	107.7318 (78)
West		0.5500	19.6403	0.6300	0.7000	0.7700	3.3013 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	169.5979	296.9567	424.3442	550.4632	635.0749	637.5518	611.8050	548.3096	468.3362	333.3913	204.6909	144.0918	(83)
Total gains	700.1519	840.0332	943.8546	1050.2817	1108.0580	1089.2415	1045.0930	982.6258	916.7275	801.3989	703.2096	662.9874	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6631	44.8325	44.9997	45.8025	45.9559	46.6836	46.6836	46.8209	46.4006	45.9559	45.6466	45.3278	
alpha	3.9775	3.9888	4.0000	4.0535	4.0637	4.1122	4.1122	4.1214	4.0934	4.0637	4.0431	4.0219	
util living area	0.9750	0.9504	0.9072	0.8121	0.6707	0.4966	0.3639	0.4016	0.6145	0.8547	0.9538	0.9792	(86)
MIT	19.5684	19.8667	20.2205	20.6162	20.8595	20.9688	20.9931	20.9898	20.9261	20.5926	20.0237	19.5286	(87)
Th 2	20.0424	20.0457	20.0489	20.0640	20.0668	20.0801	20.0801	20.0825	20.0750	20.0668	20.0611	20.0551	(88)
util rest of house	0.9698	0.9407	0.8896	0.7794	0.6200	0.4309	0.2896	0.3242	0.5462	0.8209	0.9431	0.9749	(89)
MIT 2	18.3882	18.7631	19.2005	19.6790	19.9450	20.0596	20.0771	20.0778	20.0213	19.6666	18.9759	18.3469	(90)
Living area fraction										fLA = Living area / (4) =		0.3333	(91)
MIT	18.7816	19.1310	19.5405	19.9914	20.2499	20.3627	20.3824	20.3818	20.3229	19.9753	19.3252	18.7408	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7816	19.1310	19.5405	19.9914	20.2499	20.3627	20.3824	20.3818	20.3229	19.9753	19.3252	18.7408	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9608	0.9292	0.8786	0.7766	0.6303	0.4515	0.3142	0.3498	0.5652	0.8172	0.9326	0.9668	(94)
Useful gains	672.7133	780.5858	829.2742	815.6575	698.4620	491.7861	328.3797	343.6771	518.1554	654.8869	655.8177	641.0016	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1322.0822	1294.2919	1181.6144	987.3908	758.5936	503.3289	330.3677	346.7585	546.8406	831.8292	1092.0343	1308.0203	(97)
Space heating kWh	483.1305	345.2105	262.1411	123.6480	44.7380	0.0000	0.0000	0.0000	0.0000	131.6451	314.0760	496.2620	(98a)
Space heating requirement - total per year (kWh/year)												2200.8511	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	483.1305	345.2105	262.1411	123.6480	44.7380	0.0000	0.0000	0.0000	0.0000	131.6451	314.0760	496.2620	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2200.8511	
Space heating per m2											(98c) / (4) =	25.2971	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.4000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	483.1305	345.2105	262.1411	123.6480	44.7380	0.0000	0.0000	0.0000	0.0000	131.6451	314.0760	496.2620	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	522.8685	373.6044	283.7025	133.8182	48.4177	0.0000	0.0000	0.0000	0.0000	142.4730	339.9091	537.0801	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	238.2586	210.6979	224.0675	197.8344	192.2714	173.8158	172.0763	178.6758	180.3508	200.4030	212.1831	235.7916	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.8628	85.4321	84.7186	83.4032	81.7936	80.3000	80.3000	80.3000	80.3000	83.5026	85.2201	85.9356	(217)
Fuel for water heating, kWh/month	277.4874	246.6261	264.4843	237.2024	235.0691	216.4581	214.2918	222.5103	224.5963	239.9962	248.9825	274.3819	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.4652	19.6269	17.6718	12.9471	10.0007	8.1707	9.1230	11.8584	15.4029	20.2095	22.8266	25.1452	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.3457	-24.6685	-37.9243	-45.6973	-51.9963	-49.5274	-48.9147	-44.8091	-38.0827	-29.5029	-18.5342	-13.9483	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.8852	-10.5816	-21.6184	-33.3571	-44.9992	-45.5540	-45.0292	-37.7217	-27.1178	-15.4279	-6.6140	-3.8415	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2381.8735	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2902.0864	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	197.4482	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-716.6988	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4850.7092	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2381.8735	0.2100	500.1934	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2902.0864	0.2100	609.4381	(264)
Space and water heating			1109.6316	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	197.4482	0.1443	28.4979	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-419.9513	0.1332	-55.9341	
PV Unit electricity exported	-296.7476	0.1251	-37.1258	
Total			-93.0599	(269)
Total CO2, kg/year			1056.9988	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2381.8735	1.1300	2691.5170	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2902.0864	1.1300	3279.3576	(278)
Space and water heating			5970.8746	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	197.4482	1.5338	302.8526	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-419.9513	1.4922	-626.6407	
PV Unit electricity exported	-296.7476	0.4592	-136.2658	
Total			-762.9065	(283)
Total Primary energy kWh/year			5640.9215	(286)
Target Primary Energy Rate (TPER)			64.8400	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 5	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	14.82	**TER**	13.59
Environmental	89 B	**% DER < TER**			-9.05
CO_2 Emissions (t/year)	0.77	**DFEE**	32.76	**TFEE**	29.08
Compliance Check	See BREL	**% DFEE < TFEE**			-12.64
% DPER < TPER	-9.23	**DPER**	79.67	**TPER**	72.94

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	158.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			15.6000	1.1450	17.8626			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1800	6.8742	70.0000	2673.3000	(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.5448			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			61.0000			30.0000	1830.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12845.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		210.5820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.3000	2.4600
E3 Sill	4.0300	0.0400	0.1612
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680

E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8348 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 35.3796 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	67.5662	67.3325	67.1035	66.0277	65.8264	64.8894	64.8894	64.7159	65.2503	65.8264	66.2336	66.6593	(39)

Average = Sum(39)m / 12 = 66.0267

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1076	1.1038	1.1001	1.0824	1.0791	1.0638	1.0638	1.0609	1.0697	1.0791	1.0858	1.0928	(40)
HLP (average)												1.0824	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

26.3466	25.9553	25.4043	24.3884	23.6276	22.7841	22.3284	22.8756	23.4714	24.3740	25.4109	26.2576	(42b)

Hot water usage for other uses

37.0652	35.7174	34.3696	33.0218	31.6739	30.3261	30.3261	31.6739	33.0218	34.3696	35.7174	37.0652	(42c)

Average daily hot water use (litres/day) 118.1951 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.5682	125.8499	122.5242	117.4304	113.3071	108.8690	107.1363	110.4473	113.9432	118.6060	123.7793	128.2294	(44)
Energy conte	203.6205	179.2085	188.3151	160.7563	152.5332	133.8672	129.5721	136.7569	140.5033	160.9472	176.3463	200.7763	(45)
Energy content (annual)										Total = Sum(45)m =		1963.2030	
Distribution loss (46)m = 0.15 x (45)m	30.5431	26.8813	28.2473	24.1134	22.8800	20.0801	19.4358	20.5135	21.0755	24.1421	26.4519	30.1164	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	254.5794	225.2359	239.2740	210.0714	203.4921	183.1822	180.5310	187.7158	189.8184	211.9061	225.6614	251.7352	(62)
WWHRS	-50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	204.3391	180.8030	192.7464	171.5447	167.5866	152.4576	151.7316	157.0905	158.0296	174.4305	183.2062	202.4253	(64)
									Total per year (kWh/year) = Sum(64)m =			2096.3912	(64)
12Total per year (kWh/year)												2096	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	80.4436	71.0937	75.3545	65.7802	63.4570	56.8396	55.8224	58.2114	59.0461	66.2547	70.9639	79.4979	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	108.1231	105.7942	101.2829	91.3615	85.2917	78.9439	75.0302	78.2411	82.0085	89.0520	98.5610	106.8520	(72)
Total internal gains	428.2257	437.1991	418.6181	401.8787	380.5290	362.5425	347.9372	349.3274	360.6328	377.4942	402.2831	419.2128	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	540.5282	637.8969	714.1156	796.3586	843.4176	830.0471	795.4425	745.4331	690.8012	605.3364	538.6075	514.0943	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	52.8104	52.9936	53.1745	54.0409	54.2061	54.9889	54.9889	55.1363	54.6847	54.2061	53.8729	53.5289

alpha	4.5207	4.5329	4.5450	4.6027	4.6137	4.6659	4.6659	4.6758	4.6456	4.6137	4.5915	4.5686	
util living area	0.9810	0.9607	0.9205	0.8228	0.6715	0.4902	0.3570	0.3961	0.6176	0.8684	0.9627	0.9844	(86)
MIT	19.7886	20.0448	20.3596	20.7075	20.9066	20.9829	20.9969	20.9950	20.9519	20.6762	20.1818	19.7529	(87)
Th 2	19.9946	19.9977	20.0008	20.0152	20.0179	20.0305	20.0305	20.0329	20.0257	20.0179	20.0124	20.0067	(88)
util rest of house	0.9761	0.9512	0.9020	0.7864	0.6151	0.4200	0.2793	0.3144	0.5424	0.8315	0.9521	0.9803	(89)
MIT 2	18.9154	19.1671	19.4696	19.7960	19.9594	20.0229	20.0297	20.0314	20.0013	19.7803	19.3157	18.8899	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	19.2733	19.5268	19.8344	20.1696	20.3476	20.4163	20.4261	20.4263	20.3909	20.1475	19.6707	19.2436	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2733	19.5268	19.8344	20.1696	20.3476	20.4163	20.4261	20.4263	20.3909	20.1475	19.6707	19.2436	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9717	0.9459	0.8985	0.7926	0.6347	0.4484	0.3112	0.3479	0.5715	0.8369	0.9476	0.9764	(94)
Useful gains	525.2475	603.3975	641.6286	631.1579	535.3459	372.1523	247.5233	259.3184	394.8140	506.6219	510.3966	501.9644	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1011.6877	984.8606	894.7832	744.1042	569.2396	377.4177	248.2707	260.5652	410.4824	628.4778	832.5991	1002.7947	(97)
Space heating kWh	361.9115	256.3432	188.3470	81.3213	25.2169	0.0000	0.0000	0.0000	0.0000	90.6608	231.9858	372.6178	(98a)
Space heating requirement - total per year (kWh/year)												1608.4042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	361.9115	256.3432	188.3470	81.3213	25.2169	0.0000	0.0000	0.0000	0.0000	90.6608	231.9858	372.6178	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1608.4042	
Space heating per m2											(98c) / (4) =	26.3673	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	361.9115	256.3432	188.3470	81.3213	25.2169	0.0000	0.0000	0.0000	0.0000	90.6608	231.9858	372.6178	(98)
Space heating efficiency (main heating system 1)	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)	436.0380	308.8472	226.9241	97.9775	30.3818	0.0000	0.0000	0.0000	0.0000	109.2299	279.5009	448.9371	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	204.3391	180.8030	192.7464	171.5447	167.5866	152.4576	151.7316	157.0905	158.0296	174.4305	183.2062	202.4253	(64)
Efficiency of water heater												79.4000	(216)
(217)m	84.6898	84.2268	83.4296	81.9764	80.4280	79.4000	79.4000	79.4000	79.4000	82.1455	83.9860	84.7680	(217)
Fuel for water heating, kWh/month	241.2795	214.6620	231.0288	209.2610	208.3684	192.0121	191.0977	197.8470	199.0297	212.3433	218.1389	238.7993	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	21.8087	17.4957	15.7530	11.5413	8.9148	7.2835	8.1324	10.5708	13.7304	18.0151	20.3480	22.4148	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.6043	-20.4515	-31.3194	-37.5924	-42.6571	-40.6099	-40.1392	-36.8522	-31.4116	-24.4338	-15.4091	-11.6196	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.2406	-9.1768	-18.7272	-28.8542	-38.8693	-39.3076	-38.8222	-32.5164	-23.3905	-13.3313	-5.7283	-3.3330	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1937.8364	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2553.8678	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	53.3000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	98.3000	(231)
Electricity for lighting (calculated in Appendix L)	176.0085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-602.3977	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4163.6150	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1937.8364	0.2100	406.9456	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2553.8678	0.2100	536.3122	(264)
Space and water heating			943.2579	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	176.0085	0.1443	25.4035	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-346.1002	0.1333	-46.1201	
PV Unit electricity exported	-256.2976	0.1252	-32.0805	
Total			-78.2006	(269)
Total CO2, kg/year			904.0961	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.8200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1937.8364	1.1300	2189.7551	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2553.8678	1.1300	2885.8707	(278)
Space and water heating			5075.6258	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	176.0085	1.5338	269.9678	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-346.1002	1.4924	-516.5261	
PV Unit electricity exported	-256.2976	0.4594	-117.7487	
Total			-634.2748	(283)
Total Primary energy kWh/year			4860.0270	(286)
Dwelling Primary energy Rate (DPER)			79.6700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)

TER Opening Type			12.9100	1.1450	14.7824		(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584		(29a)
Total net area of external elements Aum(A, m2)			56.1300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.4808		(33)
Main dwelling							
Party Wall 1			32.7900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			220.5820	(35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100	
E3 Sill	4.0300	0.0500	0.2015	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.8251	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	30.3059	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	62.4925	62.2589	62.0298	60.9540	60.7527	59.8157	59.8157	59.6422	60.1766	60.7527	61.1599	61.5856	(39)
Average = Sum(39)m / 12 =												60.9530	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0206	1.0169	0.9992	0.9959	0.9806	0.9806	0.9777	0.9865	0.9959	1.0026	1.0096	(40)
HLP (average)												0.9992	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0098	(42)
Hot water usage for mixer showers													
	57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)
Hot water usage for baths													
	25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)
Hot water usage for other uses													
	35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)
Average daily hot water use (litres/day)												108.6142	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m													
	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.1691	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	238.0923	210.6907	223.9644	197.0124	191.0935	172.2990	169.2359	176.6483	178.4640	198.8945	211.3894	235.4858	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
										Total per year (kWh/year) = Sum(64)m =		2157.2560	(64)
12Total per year (kWh/year)												2157	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	74.9616	66.2574	70.2641	61.4381	59.3345	53.2209	52.1320	54.5314	55.2708	61.9283	66.2185	74.0949	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)													
	100.7548	98.5973	94.4409	85.3307	79.7506	73.9179	70.0699	73.2949	76.7650	83.2370	91.9701	99.5899	(72)
Total internal gains													
	421.0597	430.2262	411.9783	396.0569	375.1902	357.7256	343.1791	344.5834	355.5982	371.8814	395.9012	412.1530	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1200	10.6334	0.6300	0.7000	0.7700	6.8894	(74)

East			7.0400		19.6403		0.6300		0.7000		0.7700		42.2563 (76)
South			3.7500		46.7521		0.6300		0.7000		0.7700		53.5801 (78)
Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	523.7855	613.8049	682.2621	756.8684	798.5671	785.3233	752.4852	706.8799	657.5911	580.2867	520.5996	498.9440	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8094	60.0339	60.2555	61.3190	61.5222	62.4859	62.4859	62.6677	62.1111	61.5222	61.1126	60.6901	
alpha	4.9873	5.0023	5.0170	5.0879	5.1015	5.1657	5.1657	5.1778	5.1407	5.1015	5.0742	5.0460	
util living area	0.9837	0.9648	0.9255	0.8247	0.6672	0.4813	0.3488	0.3863	0.6081	0.8695	0.9661	0.9868	(86)
MIT	19.9498	20.1841	20.4665	20.7736	20.9356	20.9903	20.9985	20.9975	20.9693	20.7456	20.3068	19.9188	(87)
Th 2	20.0630	20.0662	20.0693	20.0840	20.0867	20.0995	20.0995	20.1019	20.0946	20.0867	20.0811	20.0753	(88)
util rest of house	0.9795	0.9561	0.9079	0.7892	0.6131	0.4162	0.2779	0.3118	0.5370	0.8332	0.9562	0.9833	(89)
MIT 2	18.8590	19.1540	19.5015	19.8675	20.0356	20.0940	20.0990	20.1010	20.0750	19.8486	19.3224	18.8292	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	19.3061	19.5761	19.8970	20.2389	20.4045	20.4613	20.4677	20.4684	20.4415	20.2162	19.7258	19.2757	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3061	19.5761	19.8970	20.2389	20.4045	20.4613	20.4677	20.4684	20.4415	20.2162	19.7258	19.2757	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9506	0.9042	0.7956	0.6325	0.4426	0.3070	0.3424	0.5649	0.8389	0.9515	0.9794	(94)
Useful gains	510.7226	583.4844	616.9180	602.1517	505.0854	347.5679	230.9843	242.0195	371.4902	486.8075	495.3536	488.6494	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	937.7669	913.7201	831.0143	691.1484	528.8210	350.6002	231.3465	242.6483	381.6118	584.2091	772.1955	928.4484	(97)
Space heating kWh	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98a)
Space heating requirement - total per year (kWh/year)												1379.6673	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1379.6673	
Space heating per m2											(98c) / (4) =	22.6175	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	343.8538	240.1715	172.3892	69.3481	19.1118	0.0000	0.0000	0.0000	0.0000	78.4273	215.7210	354.1238	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.2500	84.7461	83.9041	82.4218	81.0292	80.3000	80.3000	80.3000	80.3000	82.6014	84.4955	85.3327	(217)
Fuel for water heating, kWh/month	248.2289	220.9826	237.7048	214.3952	212.4801	194.4045	191.8535	199.8860	201.3836	216.8783	223.6985	245.5085	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1493.1464	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2607.4045	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3832.7739	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1493.1464	0.2100	313.5607	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2607.4045	0.2100	547.5549	(264)
Space and water heating			861.1157	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			829.2382	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1493.1464	1.1300	1687.2554	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2607.4045	1.1300	2946.3671	(278)
Space and water heating			4633.6225	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4449.3847	(286)
Target Primary Energy Rate (TPER)			72.9400	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 6	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	83 B	**DER**	17.28	**TER**	15.50
Environmental	88 B	**% DER < TER**			-11.48
CO_2 Emissions (t/year)	0.75	**DFEE**	38.68	**TFEE**	32.55
Compliance Check	See BREL	**% DFEE < TFEE**			-18.84
% DPER < TPER	-11.52	**DPER**	93.02	**TPER**	83.41

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	130.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1538 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4038 (18)
Number of sides sheltered			0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.4038 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			16.3200	1.1450	18.6870			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1800	5.7258	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1700	1.3974	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			58.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.6182			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9072.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.4460 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3000	0.3000	3.0900
E3 Sill	6.6300	0.0400	0.2652
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598
E16 Corner (normal)	5.2000	0.0900	0.4680

E18 Party wall between dwellings										5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)										11.8400	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													8.4380 (36)
Point Thermal bridges												(36a) =	0.0000
Total fabric heat loss											(33) + (36) + (36a) =		37.0562 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	64.1932	63.9723	63.7559	62.7392	62.5490	61.6635	61.6635	61.4995	62.0045	62.5490	62.9338	63.3361	(39)
Average = Sum(39)m / 12 =												62.7383	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2839	1.2794	1.2751	1.2548	1.2510	1.2333	1.2333	1.2300	1.2401	1.2510	1.2587	1.2667	(40)
HLP (average)												1.2548	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6901 (42)
Hot water usage for mixer showers	59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)
Hot water usage for baths	23.9204	23.5652	23.0649	22.1425	21.4518	20.6860	20.2723	20.7691	21.3099	22.1294	23.0709	23.8396	(42b)
Hot water usage for other uses	33.6193	32.3968	31.1742	29.9517	28.7292	27.5067	27.5067	28.7292	29.9517	31.1742	32.3968	33.6193	(42c)
Average daily hot water use (litres/day)												107.2537	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	116.6663	114.1999	111.1824	106.5601	102.8186	98.7914	97.2188	100.2231	103.3951	107.6263	112.3208	116.3589	(44)
Energy conte	184.7709	162.6192	170.8831	145.8754	138.4136	121.4756	117.5778	124.0972	127.4966	146.0478	160.0215	182.1899	(45)
Energy content (annual)											Total = Sum(45)m =	1781.4685	
Distribution loss (46)m = 0.15 x (45)m	27.7156	24.3929	25.6325	21.8813	20.7620	18.2213	17.6367	18.6146	19.1245	21.9072	24.0032	27.3285	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.7190	49.5417	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	235.7298	208.6466	221.8420	195.1905	189.3725	170.1946	167.1194	175.0561	176.8116	197.0067	209.3366	233.1488	(62)
WWHRS	-45.5909	-40.3210	-42.2218	-34.9613	-32.5827	-27.8812	-26.1342	-27.7911	-28.8470	-34.0074	-38.5263	-44.7466	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	190.1389	168.3256	179.6202	160.2291	156.7898	142.3134	140.9852	147.2650	147.9646	162.9993	170.8103	188.4021	(64)
										Total per year (kWh/year) = Sum(64)m =		1955.8435	(64)
12Total per year (kWh/year)												1956	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	74.1760	65.5777	69.5584	60.8323	58.7623	52.5704	51.4800	54.0020	54.7214	61.3006	65.5359	73.3179	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	99.6990	97.5859	93.4924	84.4894	78.9815	73.0144	69.1936	72.5834	76.0019	82.3933	91.0221	98.5455	(72)
Total internal gains	372.5470	379.9185	364.0183	349.2942	330.9646	314.7487	301.9561	303.8181	313.5621	328.6744	350.1251	364.8972	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	505.7804	616.0553	705.9105	795.2556	844.2319	828.5815	795.6964	747.8637	692.1942	595.2670	511.5178	477.6724	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.2578	39.3933	39.5271	40.1676	40.2898	40.8683	40.8683	40.9773	40.6435	40.2898	40.0434	39.7891	

alpha	3.6172	3.6262	3.6351	3.6778	3.6860	3.7246	3.7246	3.7318	3.7096	3.6860	3.6696	3.6526	
util living area	0.9640	0.9313	0.8757	0.7676	0.6233	0.4601	0.3369	0.3720	0.5739	0.8200	0.9369	0.9697	(86)
MIT	19.4484	19.7877	20.1853	20.6026	20.8515	20.9639	20.9912	20.9873	20.9180	20.5657	19.9439	19.3988	(87)
Th 2	19.8535	19.8570	19.8604	19.8764	19.8794	19.8935	19.8935	19.8961	19.8881	19.8794	19.8733	19.8670	(88)
util rest of house	0.9559	0.9170	0.8512	0.7264	0.5643	0.3864	0.2541	0.2855	0.4956	0.7766	0.9212	0.9629	(89)
MIT 2	18.4865	18.8156	19.1929	19.5799	19.7853	19.8767	19.8910	19.8921	19.8456	19.5634	18.9852	18.4483	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	18.9867	19.3211	19.7089	20.1117	20.3397	20.4420	20.4631	20.4616	20.4032	20.0846	19.4838	18.9425	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9867	19.3211	19.7089	20.1117	20.3397	20.4420	20.4631	20.4616	20.4032	20.0846	19.4838	18.9425	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9484	0.9091	0.8475	0.7356	0.5893	0.4235	0.2970	0.3303	0.5330	0.7853	0.9148	0.9558	(94)
Useful gains	479.6603	560.0838	598.2852	584.9772	497.5449	350.9071	236.3365	246.9944	368.9290	467.4410	467.9250	456.5702	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	942.7863	922.5486	842.1477	703.4129	540.4067	360.2409	238.2117	249.7882	390.8294	593.2531	779.3565	933.7337	(97)
Space heating kWh	344.5658	243.5764	181.4337	85.2737	31.8891	0.0000	0.0000	0.0000	0.0000	93.6042	224.2307	355.0096	(98a)
Space heating requirement - total per year (kWh/year)												1559.5832	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	344.5658	243.5764	181.4337	85.2737	31.8891	0.0000	0.0000	0.0000	0.0000	93.6042	224.2307	355.0096	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1559.5832	
Space heating per m2											(98c) / (4) =	31.1917	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	344.5658	243.5764	181.4337	85.2737	31.8891	0.0000	0.0000	0.0000	0.0000	93.6042	224.2307	355.0096	(98)
Space heating efficiency (main heating system 1)	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)	415.1395	293.4655	218.5949	102.7393	38.4207	0.0000	0.0000	0.0000	0.0000	112.7761	270.1574	427.7224	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	190.1389	168.3256	179.6202	160.2291	156.7898	142.3134	140.9852	147.2650	147.9646	162.9993	170.8103	188.4021	(64)
Efficiency of water heater												79.4000	(216)
(217)m	84.7363	84.2700	83.5006	82.1899	80.7335	79.4000	79.4000	79.4000	79.4000	82.3352	84.0631	84.8150	(217)
Fuel for water heating, kWh/month	224.3888	199.7456	215.1124	194.9499	194.2067	179.2360	177.5632	185.4722	186.3534	197.9704	203.1930	222.1330	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	17.4563	14.0041	12.6091	9.2380	7.1357	5.8299	6.5094	8.4612	10.9902	14.4198	16.2871	17.9414	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.2876	-16.9932	-26.0658	-31.3472	-35.6351	-33.9598	-33.5736	-30.7942	-26.2014	-20.3319	-12.7956	-9.6388	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4642	-7.4995	-15.3061	-23.5820	-31.7600	-32.1054	-31.7012	-26.5505	-19.1017	-10.8872	-4.6780	-2.7220	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1879.0159	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2380.3245	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	53.3000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	98.3000	(231)
Electricity for lighting (calculated in Appendix L)	140.8820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-497.9821	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4000.5402	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1879.0159	0.2100	394.5933	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2380.3245	0.2100	499.8682	(264)
Space and water heating			894.4615	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	140.8820	0.1443	20.3336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.6243	0.1332	-38.4491	
PV Unit electricity exported	-209.3578	0.1252	-26.2069	
Total			-64.6560	(269)
Total CO2, kg/year			863.7745	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			17.2800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1879.0159	1.1300	2123.2879	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2380.3245	1.1300	2689.7667	(278)
Space and water heating			4813.0546	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	140.8820	1.5338	216.0894	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.6243	1.4923	-430.7031	
PV Unit electricity exported	-209.3578	0.4595	-96.1903	
Total			-526.8933	(283)
Total Primary energy kWh/year			4650.9590	(286)
Dwelling Primary energy Rate (DPER)			93.0200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)

TER Opening Type			10.1500	1.1450	11.6221		(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364		(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796		(29a)
Total net area of external elements Aum(A, m2)			58.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.2781		(33)
Main dwelling							
Party Wall 1			15.3900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	191.4460	(35)
List of Thermal Bridges		

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9293	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	28.2074	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	55.3444	55.1236	54.9071	53.8904	53.7002	52.8147	52.8147	52.6507	53.1558	53.7002	54.0850	54.4873	(39)
Average = Sum(39)m / 12 =												53.8895	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1069	1.1025	1.0981	1.0778	1.0740	1.0563	1.0563	1.0530	1.0631	1.0740	1.0817	1.0897	(40)
HLP (average)												1.0778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6901	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)
Average daily hot water use (litres/day)												98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
										Total per year (kWh/year) = Sum(64)m =		1992.9475	(64)
12Total per year (kWh/year)												1993	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557	(72)
Total internal gains	366.2732	373.8444	358.2220	343.8889	325.4004	309.2388	296.7585	298.3915	308.3807	323.6261	344.5705	358.7198	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7800	19.6403	0.6300	0.7000	0.7700	34.6934	(76)

South			3.7000		46.7521		0.6300		0.7000		0.7700		52.8657 (78)
West			0.6700		19.6403		0.6300		0.7000		0.7700		4.0216 (80)
Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	457.8540	536.1596	593.2344	650.4414	678.2217	662.4500	636.1575	603.6283	568.6491	506.8768	455.5074	436.2380	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0441	48.2366	48.4267	49.3404	49.5151	50.3453	50.3453	50.5021	50.0223	49.5151	49.1628	48.7999	
alpha	4.2029	4.2158	4.2284	4.2894	4.3010	4.3564	4.3564	4.3668	4.3348	4.3010	4.2775	4.2533	
util living area	0.9729	0.9490	0.9064	0.8120	0.6715	0.4965	0.3624	0.3967	0.6071	0.8485	0.9502	0.9772	(86)
MIT	19.7280	19.9930	20.3121	20.6685	20.8823	20.9756	20.9950	20.9927	20.9422	20.6563	20.1478	19.6955	(87)
Th 2	19.9952	19.9988	20.0024	20.0190	20.0221	20.0367	20.0367	20.0394	20.0311	20.0221	20.0158	20.0092	(88)
util rest of house	0.9668	0.9380	0.8869	0.7763	0.6170	0.4269	0.2845	0.3160	0.5344	0.8106	0.9376	0.9719	(89)
MIT 2	18.5429	18.8748	19.2671	19.6954	19.9244	20.0218	20.0348	20.0364	19.9919	19.6956	19.0851	18.5122	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	19.1592	19.4563	19.8105	20.2014	20.4225	20.5178	20.5341	20.5337	20.4861	20.1951	19.6377	19.1275	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1592	19.4563	19.8105	20.2014	20.4225	20.5178	20.5341	20.5337	20.4861	20.1951	19.6377	19.1275	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9603	0.9309	0.8826	0.7834	0.6400	0.4622	0.3249	0.3579	0.5695	0.8180	0.9318	0.9659	(94)
Useful gains	439.6766	499.1278	523.6068	509.5275	434.0850	306.1732	206.7081	216.0161	323.8422	414.6006	424.4402	421.3812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	822.3718	802.3943	730.8413	609.0395	468.3983	312.5461	207.7794	217.6406	339.4556	515.2610	678.1017	813.3609	(97)
Space heating kWh	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98a)
Space heating requirement - total per year (kWh/year)												1289.0410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1289.0410	
Space heating per m2											(98c) / (4) =	25.7808	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	308.1442	220.5575	166.8642	77.5418	27.6288	0.0000	0.0000	0.0000	0.0000	81.0512	197.6583	315.6200	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.1725	84.7186	83.9856	82.7347	81.3945	80.3000	80.3000	80.3000	80.3000	82.7822	84.4599	85.2437	(217)
Fuel for water heating, kWh/month	230.9921	205.6197	221.1071	198.0806	194.2729	176.4186	174.0932	182.2506	185.3789	201.4076	208.4800	228.5465	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1395.0661	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2406.6478	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3601.0410	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1395.0661	0.2100	292.9639	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2406.6478	0.2100	505.3960	(264)
Space and water heating			798.3599	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			774.8498	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.5000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1395.0661	1.1300	1576.4247	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2406.6478	1.1300	2719.5120	(278)
Space and water heating			4295.9367	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4170.7442	(286)
Target Primary Energy Rate (TPER)			83.4100	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 7	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	82 B	**DER**	18.93	**TER**	17.71
Environmental	89 B	**% DER < TER**			-6.89
CO_2 Emissions (t/year)	0.64	**DFEE**	37.83	**TFEE**	34.69
Compliance Check	See BREL	**% DFEE < TFEE**			-9.05
% DPER < TPER	-6.81	**DPER**	102.24	**TPER**	95.72

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000	(1b)	x 2.6000	(2b) =	101.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	101.4000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1972 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4472 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4472 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5702	0.5590	0.5479	0.4920	0.4808	0.4249	0.4249	0.4137	0.4472	0.4808	0.5031	0.5255	(22b)
Effective ac	0.6626	0.6563	0.6501	0.6210	0.6156	0.5903	0.5903	0.5856	0.6000	0.6156	0.6266	0.6381	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			7.6400	1.1450	8.7481			(27)
EXTERNAL	36.0400	9.9800	26.0600	0.1800	4.6908	70.0000	1824.2000	(29a)
HALLWAY	8.2200		8.2200	0.1700	1.3974	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.6443			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			39.0000			40.0000	1560.0000	(32d)
Party Ceiling 1			39.0000			30.0000	1170.0000	(32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		8958.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							229.6974	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.8000	0.3000	1.7400
E3 Sill	4.8000	0.0400	0.1920
E4 Jamb	13.3400	0.0500	0.6670
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828
E16 Corner (normal)	5.2000	0.0900	0.4680

E18 Party wall between dwellings									2.6000	0.0600	0.1560		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)									16.3600	0.0000	0.0000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												5.6058	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		23.2501	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.1713	21.9600	21.7530	20.7804	20.5984	19.7513	19.7513	19.5944	20.0776	20.5984	20.9665	21.3514	(38)
Heat transfer coeff	45.4214	45.2101	45.0030	44.0304	43.8485	43.0014	43.0014	42.8445	43.3277	43.8485	44.2166	44.6015	(39)
Average = Sum(39)m / 12 =												44.0296	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1647	1.1592	1.1539	1.1290	1.1243	1.1026	1.1026	1.0986	1.1110	1.1243	1.1338	1.1436	(40)
HLP (average)												1.1290	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3800	(42)
Hot water usage for mixer showers	53.2775	52.4768	51.3101	49.0778	47.4304	45.5933	44.5491	45.7069	46.9762	48.9487	51.2290	53.0734	(42a)
Hot water usage for baths	21.5670	21.2467	20.7956	19.9640	19.3412	18.6507	18.2777	18.7256	19.2133	19.9522	20.8010	21.4941	(42b)
Hot water usage for other uses	30.2766	29.1756	28.0747	26.9737	25.8727	24.7718	24.7718	25.8727	26.9737	28.0747	29.1756	30.2766	(42c)
Average daily hot water use (litres/day)												96.6402	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.1211	102.8991	100.1804	96.0155	92.6444	89.0158	87.5986	90.3053	93.1632	96.9756	101.2056	104.8440	(44)
Energy conte	166.4861	146.5270	153.9735	131.4404	124.7172	109.4553	105.9429	111.8168	114.8796	131.5949	144.1859	164.1604	(45)
Energy content (annual)										Total = Sum(45)m =		1605.1799	
Distribution loss (46)m = 0.15 x (45)m	24.9729	21.9790	23.0960	19.7161	18.7076	16.4183	15.8914	16.7725	17.2319	19.7392	21.6279	24.6241	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	47.3501	47.2106	43.8982	44.6393	46.0186	45.9435	49.4177	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	217.4450	192.5544	204.9324	178.7905	171.9277	153.3535	150.5821	157.8354	160.8231	181.0126	193.5010	215.1193	(62)
WWHRS	-41.0809	-36.3323	-38.0450	-31.5028	-29.3595	-25.1231	-23.5489	-25.0419	-25.9933	-30.6433	-34.7151	-40.3201	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	176.3641	156.2221	166.8874	147.2877	142.5683	128.2304	127.0332	132.7935	134.8297	150.3694	158.7858	174.7992	(64)
										Total per year (kWh/year) = Sum(64)m =		1796.1709	(64)
12Total per year (kWh/year)												1796	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	68.0963	60.2271	63.9359	55.5415	53.2711	47.3684	46.3858	48.6837	49.6833	56.1097	60.2706	67.3231	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.8268	68.4511	61.8268	63.8877	61.8268	63.8877	61.8268	61.8268	63.8877	61.8268	63.8877	61.8268	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	91.5273	89.6236	85.9354	77.1409	71.6009	65.7895	62.3465	65.4351	69.0046	75.4163	83.7091	90.4880	(72)
Total internal gains	319.0813	325.0370	311.6120	298.2523	282.2872	267.6754	256.9198	258.7733	267.5161	281.4930	300.2110	312.7902	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains	41.4903	81.1639	133.6653	194.9429	238.9099	244.5668	232.8375	200.0040	155.4583	96.3078	51.7336	34.1196	(83)
Total gains	360.5716	406.2009	445.2773	493.1952	521.1971	512.2422	489.7573	458.7773	422.9744	377.8008	351.9445	346.9098	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	54.7845	55.0405	55.2938	56.5152	56.7497	57.8677	57.8677	58.0795	57.4319	56.7497	56.2773	55.7917
alpha	4.6523	4.6694	4.6863	4.7677	4.7833	4.8578	4.8578	4.8720	4.8288	4.7833	4.7518	4.7194

util living area													
	0.9833	0.9699	0.9402	0.8569	0.7130	0.5248	0.3840	0.4256	0.6621	0.8949	0.9685	0.9856	(86)
MIT	19.8167	20.0210	20.3135	20.6751	20.8932	20.9810	20.9966	20.9945	20.9440	20.6518	20.1934	19.8020	(87)
Th 2	19.9484	19.9528	19.9570	19.9772	19.9810	19.9987	19.9987	20.0020	19.9919	19.9810	19.9734	19.9654	(88)
util rest of house													
	0.9786	0.9617	0.9242	0.8220	0.6539	0.4479	0.2978	0.3353	0.5815	0.8603	0.9585	0.9816	(89)
MIT 2	18.9001	19.1028	19.3873	19.7344	19.9152	19.9906	19.9979	20.0005	19.9643	19.7262	19.2902	18.8989	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	19.5817	19.7856	20.0761	20.4339	20.6424	20.7271	20.7405	20.7396	20.6928	20.4145	19.9618	19.5704	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5817	19.7856	20.0761	20.4339	20.6424	20.7271	20.7405	20.7396	20.6928	20.4145	19.9618	19.5704	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9766	0.9602	0.9262	0.8385	0.6932	0.5043	0.3618	0.4023	0.6387	0.8762	0.9584	0.9797	(94)
Useful gains	352.1332	390.0337	412.4183	413.5398	361.2680	258.3046	177.2145	184.5659	270.1441	331.0374	337.3020	339.8834	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	694.1155	672.9780	610.9642	507.8441	392.1102	263.4727	178.0476	185.9299	285.6511	430.3502	568.7046	685.5433	(97)
Space heating kWh													
	254.4348	190.1386	147.7181	67.8991	22.9466	0.0000	0.0000	0.0000	0.0000	73.8887	166.6099	257.1710	(98a)
Space heating requirement - total per year (kWh/year)												1180.8068	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	254.4348	190.1386	147.7181	67.8991	22.9466	0.0000	0.0000	0.0000	0.0000	73.8887	166.6099	257.1710	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1180.8068	
Space heating per m2											(98c) / (4) =	30.2771	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	254.4348	190.1386	147.7181	67.8991	22.9466	0.0000	0.0000	0.0000	0.0000	73.8887	166.6099	257.1710	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	306.5480	229.0826	177.9736	81.8062	27.6465	0.0000	0.0000	0.0000	0.0000	89.0225	200.7348	309.8445	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	176.3641	156.2221	166.8874	147.2877	142.5683	128.2304	127.0332	132.7935	134.8297	150.3694	158.7858	174.7992	(64)
Efficiency of water heater												79.4000	(216)
(217)m	84.2636	83.9012	83.2186	81.9263	80.4905	79.4000	79.4000	79.4000	79.4000	82.0417	83.5823	84.3050	(217)
Fuel for water heating, kWh/month													
	209.3005	186.1978	200.5410	179.7807	177.1242	161.4992	159.9915	167.2463	169.8107	183.2841	189.9754	207.3415	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	13.4326	10.7761	9.7027	7.1086	5.4909	4.4861	5.0090	6.5109	8.4570	11.0960	12.5329	13.8059	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.8125	-13.3089	-20.4833	-24.7270	-28.2033	-26.9231	-26.6257	-24.3785	-20.6758	-15.9689	-10.0068	-7.5212	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6082	-5.6532	-11.5466	-17.7988	-23.9736	-24.2241	-23.9097	-20.0174	-14.3976	-8.2008	-3.5212	-2.0484	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1422.6588	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.4000	
Water heating fuel used												2192.0928	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												53.3000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												98.3000	(231)
Electricity for lighting (calculated in Appendix L)												108.4087	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-385.5345	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3435.9257	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1422.6588	0.2100	298.7583	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2192.0928	0.2100	460.3395	(264)
Space and water heating			759.0978	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	108.4087	0.1443	15.6467	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-227.6350	0.1331	-30.3064	
PV Unit electricity exported	-157.8995	0.1252	-19.7649	
Total			-50.0713	(269)
Total CO2, kg/year			738.3086	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			18.9300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1422.6588	1.1300	1607.6044	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2192.0928	1.1300	2477.0649	(278)
Space and water heating			4084.6693	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	108.4087	1.5338	166.2809	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-227.6350	1.4920	-339.6235	
PV Unit electricity exported	-157.8995	0.4594	-72.5457	
Total			-412.1692	(283)
Total Primary energy kWh/year			3987.4892	(286)
Dwelling Primary energy Rate (DPER)			102.2400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000	(1b) x	2.6000	(2b) =	101.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		101.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1972	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4472	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4472	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5702	0.5590	0.5479	0.4920	0.4808	0.4249	0.4249	0.4137	0.4472	0.4808	0.5031	0.5255	(22b)
Effective ac	0.6626	0.6563	0.6501	0.6210	0.6156	0.5903	0.5903	0.5856	0.6000	0.6156	0.6266	0.6381	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			7.4100	1.1450	8.4847			(27)

EXTERNAL	36.0400	9.7500	26.2900	0.1800	4.7322	(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796	(29a)
Total net area of external elements Aum(A, m2)			44.2600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.0365	(33)
Main dwelling						
Party Wall 1			21.2700	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 239.6974 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900
E3 Sill	4.8000	0.0500	0.2400
E4 Jamb	13.3400	0.0500	0.6670
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	2.6000	0.0600	0.1560
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.2038 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 21.2403 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.1713	21.9600	21.7530	20.7804	20.5984	19.7513	19.7513	19.5944	20.0776	20.5984	20.9665	21.3514	(38)
Heat transfer coeff	43.4116	43.2004	42.9933	42.0207	41.8387	40.9916	40.9916	40.8347	41.3179	41.8387	42.2068	42.5917	(39)
Average = Sum(39)m / 12 =												42.0198	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1131	1.1077	1.1024	1.0775	1.0728	1.0511	1.0511	1.0470	1.0594	1.0728	1.0822	1.0921	(40)
HLP (average)												1.0774	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3800 (42)

Hot water usage for mixer showers

47.3578	46.6461	45.6090	43.6247	42.1604	40.5274	39.5992	40.6284	41.7566	43.5100	45.5369	47.1763	(42a)

Hot water usage for baths

20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)

Hot water usage for other uses

28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)

Average daily hot water use (litres/day) 88.8064 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.6092	94.5473	92.0358	88.2155	85.1137	81.7787	80.4962	82.9968	85.6343	89.1355	93.0146	96.3584	(44)
Energy conte	153.0053	134.6340	141.4555	120.7626	114.5793	100.5565	97.3532	102.7674	105.5956	120.9560	132.5164	150.8740	(45)
Energy content (annual)										Total = Sum(45)m =		1475.0560	
Distribution loss (46)m = 0.15 x (45)m	22.9508	20.1951	21.2183	18.1144	17.1869	15.0835	14.6030	15.4151	15.8393	18.1434	19.8775	22.6311	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	49.2310	43.5176	46.9004	43.5035	43.3730	40.3292	41.0200	42.2943	42.2306	45.4225	45.8702	49.1032	(61)
Total heat required for water heating calculated for each month	202.2362	178.1517	188.3559	164.2662	157.9523	140.8857	138.3732	145.0617	147.8262	166.3785	178.3866	199.9772	(62)
WWHRS	-21.6500	-19.1474	-20.0501	-16.6023	-15.4727	-13.2401	-12.4105	-13.1973	-13.6987	-16.1493	-18.2952	-21.2491	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	180.5863	159.0042	168.3059	147.6639	142.4796	127.6456	125.9627	131.8644	134.1275	150.2292	160.0914	178.7282	(64)
										Total per year (kWh/year) = Sum(64)m =		1806.6889	(64)
12Total per year (kWh/year)												1807	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	63.1820	55.6452	58.7591	51.0295	48.9409	43.5173	42.6249	44.7437	45.6682	51.5735	55.5293	62.4414	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.8308	67.3484	60.8308	62.8585	60.8308	62.8585	60.8308	60.8308	62.8585	60.8308	62.8585	60.8308	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	84.9220	82.8054	78.9772	70.8742	65.7807	60.4408	57.2916	60.1394	63.4281	69.3192	77.1240	83.9266	(72)
Total internal gains	311.4800	317.1160	303.6578	290.9564	275.4710	261.2974	250.8688	252.4815	260.9103	274.3999	292.5966	305.2328	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.7100	19.6403	0.6300	0.7000	0.7700	40.2756	(76)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	44.4772	87.0068	143.2878	208.9768	256.1089	262.1730	249.5994	214.4022	166.6497	103.2409	55.4578	36.5759	(83)
Total gains	355.9571	404.1228	446.9456	499.9332	531.5798	523.4704	500.4682	466.8837	427.5600	377.6408	348.0544	341.8086	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8163	60.1088	60.3983	61.7963	62.0651	63.3476	63.3476	63.5910	62.8474	62.0651	61.5237	60.9678	
alpha	4.9878	5.0073	5.0266	5.1198	5.1377	5.2232	5.2232	5.2394	5.1898	5.1377	5.1016	5.0645	
util living area													
	0.9851	0.9713	0.9386	0.8436	0.6857	0.4943	0.3593	0.4003	0.6373	0.8902	0.9704	0.9875	(86)
MIT	19.9291	20.1322	20.4154	20.7502	20.9290	20.9896	20.9984	20.9972	20.9635	20.7147	20.2836	19.9141	(87)
Th 2	20.4434	20.4461	20.4488	20.4613	20.4636	20.4745	20.4745	20.4765	20.4703	20.4636	20.4589	20.4540	(88)
util rest of house													
	0.9829	0.9671	0.9300	0.8244	0.6544	0.4557	0.3168	0.3555	0.5955	0.8718	0.9655	0.9856	(89)
MIT 2	19.4394	19.6421	19.9211	20.2490	20.4094	20.4679	20.4737	20.4751	20.4455	20.2230	19.8033	19.4331	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	19.8035	20.0065	20.2887	20.6217	20.7958	20.8558	20.8638	20.8633	20.8307	20.5886	20.1605	19.7908	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8035	20.0065	20.2887	20.6217	20.7958	20.8558	20.8638	20.8633	20.8307	20.5886	20.1605	19.7908	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9799	0.9634	0.9272	0.8303	0.6740	0.4838	0.3483	0.3886	0.6242	0.8764	0.9624	0.9829	(94)
Useful gains	348.8055	389.3291	414.4291	415.1003	358.2754	253.2515	174.3139	181.4532	266.8856	330.9488	334.9767	335.9620	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	673.0329	652.6059	592.8209	492.5540	380.5561	256.4363	174.7818	182.2597	278.0978	417.9115	551.2421	664.0384	(97)
Space heating kWh													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98a)
Space heating requirement - total per year (kWh/year)												1087.7143	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1087.7143	
Space heating per m2											(98c) / (4) =	27.8901	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	261.0662	191.4740	143.6402	60.3535	17.9403	0.0000	0.0000	0.0000	0.0000	70.0219	168.5185	264.1654	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5863	159.0042	168.3059	147.6639	142.4796	127.6456	125.9627	131.8644	134.1275	150.2292	160.0914	178.7282	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.0025	84.6108	83.8775	82.4875	81.1178	80.3000	80.3000	80.3000	80.3000	82.7086	84.3220	85.0497	(217)
Fuel for water heating, kWh/month													
	212.4481	187.9242	200.6567	179.0137	175.6452	158.9609	156.8651	164.2147	167.0330	181.6368	189.8573	210.1456	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	12.6394	10.1398	9.1298	6.6889	5.1667	4.2212	4.7132	6.1264	7.9576	10.4408	11.7929	12.9907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.5051	-11.4259	-17.7250	-21.5712	-24.7560	-23.6831	-23.4153	-21.3606	-18.0067	-13.7752	-8.5514	-6.3952	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0121	-4.3759	-8.9665	-13.8670	-18.7247	-18.9396	-18.6975	-15.6360	-11.2211	-6.3662	-2.7219	-1.5795	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1177.1799	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2184.4014	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	102.0075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-321.2788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3228.3100	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1177.1799	0.2100	247.2078	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2184.4014	0.2100	458.7243	(264)
Space and water heating			705.9321	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	102.0075	0.1443	14.7228	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	0.1330	-26.3533	
PV Unit electricity exported	-123.1080	0.1251	-15.3980	
Total			-41.7513	(269)
Total CO2, kg/year			690.8329	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.7100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1177.1799	1.1300	1330.2133	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2184.4014	1.1300	2468.3736	(278)
Space and water heating			3798.5869	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	102.0075	1.5338	156.4624	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	1.4914	-295.5498	
PV Unit electricity exported	-123.1080	0.4591	-56.5166	
Total			-352.0664	(283)
Total Primary energy kWh/year			3733.0837	(286)
Target Primary Energy Rate (TPER)			95.7200	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 8	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	13.68	**TER**	12.55
Environmental	89 B	**% DER < TER**			-9.00
CO_2 Emissions (t/year)	0.95	**DFEE**	35.05	**TFEE**	31.17
Compliance Check	See BREL	**% DFEE < TFEE**			-12.44
% DPER < TPER	-9.37	**DPER**	73.35	**TPER**	67.06

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	81.0000	(1b)	x 2.6000	(2b) =	210.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	210.6000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0950 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3450 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3450 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4398	0.4312	0.4226	0.3795	0.3708	0.3277	0.3277	0.3191	0.3450	0.3708	0.3881	0.4053	(22b)
Effective ac	0.5967	0.5930	0.5893	0.5720	0.5688	0.5537	0.5537	0.5509	0.5595	0.5688	0.5753	0.5821	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			23.9100	1.1450	27.3779			(27)
EXTERNAL	79.9200	26.2500	53.6700	0.1800	9.6606	70.0000	3756.9000	(29a)
External Roof 1	14.8900		14.8900	0.1100	1.6379	9.0000	134.0100	(30)
Total net area of external elements Aum(A, m2)			94.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.4844			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			81.0000			40.0000	3240.0000	(32d)
Party Ceiling 1			66.1100			30.0000	1983.3000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12942.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.7878 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.6600	0.3000	3.7980
E3 Sill	7.0000	0.0400	0.2800
E4 Jamb	31.1800	0.0500	1.5590
E7 Party floor between dwellings (in blocks of flats)	48.5600	0.0700	3.3992
E16 Corner (normal)	7.8000	0.0900	0.7020

E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	
E14 Flat roof	12.9200	0.0400	0.5168	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5670 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.0514 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.4713	41.2103	40.9544	39.7526	39.5277	38.4810	38.4810	38.2872	38.8842	39.5277	39.9826	40.4582	(38)
Heat transfer coeff	93.5227	93.2616	93.0058	91.8040	91.5791	90.5324	90.5324	90.3385	90.9356	91.5791	92.0340	92.5095	(39)

Average = Sum(39)m / 12 = 91.8029

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1546	1.1514	1.1482	1.1334	1.1306	1.1177	1.1177	1.1153	1.1227	1.1306	1.1362	1.1421	(40)
HLP (average)												1.1334	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4816 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
74.0558	72.9428	71.3211	68.2182	65.9284	63.3747	61.9232	63.5327	65.2970	68.0388	71.2083	73.7720	(42a)

Hot water usage for baths

29.9275	29.4830	28.8571	27.7031	26.8390	25.8808	25.3632	25.9847	26.6614	27.6867	28.8646	29.8263	(42b)

Hot water usage for other uses

42.1512	40.6185	39.0857	37.5529	36.0201	34.4874	34.4874	36.0201	37.5529	39.0857	40.6185	42.1512	(42c)

Average daily hot water use (litres/day) 134.3437 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1345	143.0443	139.2639	133.4742	128.7874	123.7429	121.7738	125.5376	129.5113	134.8112	140.6913	145.7496	(44)
Energy conte	231.4413	203.6932	214.0435	182.7195	173.3727	152.1563	147.2749	155.4417	159.7004	182.9375	200.4406	228.2086	(45)
Energy content (annual)										Total = Sum(45)m =		2231.4303	
Distribution loss (46)m = 0.15 x (45)m	34.7162	30.5540	32.1065	27.4079	26.0059	22.8234	22.0912	23.3163	23.9551	27.4406	30.0661	34.2313	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	282.4002	249.7206	265.0024	232.0346	224.3316	201.4713	198.2338	206.4006	209.0155	233.8965	249.7557	279.1675	(62)
WWHRS	-57.1024	-50.5019	-52.8826	-43.7889	-40.8097	-34.9211	-32.7330	-34.8083	-36.1308	-42.5942	-48.2540	-56.0450	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	225.2978	199.2188	212.1197	188.2457	183.5219	166.5502	165.5008	171.5924	172.8847	191.3023	201.5016	223.1225	(64)
										Total per year (kWh/year) = Sum(64)m =		2300.8583	(64)
12Total per year (kWh/year)												2301	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.6940	79.2348	83.9092	73.0830	70.3861	62.9207	61.7086	64.4241	65.4292	73.5665	78.9753	88.6191	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.7303	123.7014	111.7303	115.4546	111.7303	115.4546	111.7303	111.7303	115.4546	111.7303	115.4546	111.7303	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.5178	223.8165	218.0239	205.6923	190.1258	175.4954	165.7215	163.4228	169.2154	181.5470	197.1135	211.7439	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	(71)
Water heating gains (Table 5)	120.5564	117.9090	112.7812	101.5042	94.6050	87.3899	82.9417	86.5915	90.8738	98.8797	109.6879	119.1117	(72)
Total internal gains	517.0279	528.6503	505.7588	485.8745	459.6845	438.5634	420.6169	421.9681	435.7673	455.3804	485.4795	505.8093	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
South	12.1300	46.7521	0.5700	0.7000	0.7700	156.8078	(78)
West	0.3600	19.6403	0.5700	0.7000	0.7700	1.9550	(80)

Solar gains	209.5740	359.4352	497.4638	624.5001	705.9008	703.3476	677.0600	616.1182	541.5187	398.8627	251.4887	179.0382	(83)
Total gains	726.6020	888.0855	1003.2226	1110.3746	1165.5853	1141.9110	1097.6769	1038.0863	977.2860	854.2432	736.9681	684.8475	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.4423	38.5499	38.6559	39.1620	39.2581	39.7120	39.7120	39.7972	39.5360	39.2581	39.0641	38.8633	
alpha	3.5628	3.5700	3.5771	3.6108	3.6172	3.6475	3.6475	3.6531	3.6357	3.6172	3.6043	3.5909	
util living area													
	0.9639	0.9311	0.8802	0.7833	0.6480	0.4854	0.3571	0.3917	0.5894	0.8239	0.9369	0.9698	(86)
MIT	19.4068	19.7513	20.1376	20.5517	20.8207	20.9531	20.9881	20.9833	20.9041	20.5373	19.9060	19.3487	(87)
Th 2	19.9565	19.9591	19.9616	19.9737	19.9759	19.9864	19.9864	19.9884	19.9824	19.9759	19.9714	19.9666	(88)
util rest of house													
	0.9567	0.9184	0.8588	0.7473	0.5947	0.4158	0.2774	0.3092	0.5178	0.7854	0.9230	0.9637	(89)
MIT 2	18.5341	18.8691	19.2384	19.6263	19.8554	19.9625	19.9825	19.9824	19.9286	19.6267	19.0342	18.4850	(90)
Living area fraction									fLA = Living area / (4) =			0.3457	(91)
MIT	18.8358	19.1741	19.5492	19.9462	20.1891	20.3050	20.3301	20.3284	20.2658	19.9415	19.3356	18.7836	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8358	19.1741	19.5492	19.9462	20.1891	20.3050	20.3301	20.3284	20.2658	19.9415	19.3356	18.7836	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9470	0.9069	0.8492	0.7463	0.6063	0.4382	0.3047	0.3374	0.5386	0.7840	0.9126	0.9548	(94)
Useful gains	688.0910	805.3947	851.9011	828.6628	706.6935	500.4229	334.5092	350.2260	526.3750	669.7149	672.5758	653.9240	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1359.4249	1331.2235	1213.6526	1014.0854	777.4242	516.4845	337.6960	354.8869	560.6911	855.4821	1126.0873	1349.1211	(97)
Space heating kWh													
	499.4724	353.3569	269.1431	133.5043	52.6236	0.0000	0.0000	0.0000	0.0000	138.2108	326.5282	517.2267	(98a)
Space heating requirement - total per year (kWh/year)												2290.0660	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	499.4724	353.3569	269.1431	133.5043	52.6236	0.0000	0.0000	0.0000	0.0000	138.2108	326.5282	517.2267	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2290.0660	
Space heating per m2											(98c) / (4) =	28.2724	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	499.4724	353.3569	269.1431	133.5043	52.6236	0.0000	0.0000	0.0000	0.0000	138.2108	326.5282	517.2267	(98)
Space heating efficiency (main heating system 1)													
	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)													
	601.7739	425.7313	324.2688	160.8485	63.4019	0.0000	0.0000	0.0000	0.0000	166.5190	393.4075	623.1646	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	225.2978	199.2188	212.1197	188.2457	183.5219	166.5502	165.5008	171.5924	172.8847	191.3023	201.5016	223.1225	(64)
Efficiency of water heater												79.4000	(216)
(217)m	85.1336	84.6928	83.9904	82.7558	81.1677	79.4000	79.4000	79.4000	79.4000	82.7938	84.5071	85.2183	(217)
Fuel for water heating, kWh/month													
	264.6402	235.2252	252.5525	227.4714	226.1022	209.7610	208.4392	216.1113	217.7389	231.0588	238.4436	261.8248	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	28.9620	23.2344	20.9200	15.3269	11.8389	9.6725	10.7999	14.0381	18.2341	23.9241	27.0222	29.7669	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.9666	-26.9122	-41.0565	-49.0713	-55.4784	-52.7211	-52.0964	-47.9266	-40.9979	-32.0567	-20.3129	-15.3552	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-5.8266	-12.5923	-25.6724	-39.5242	-53.2234	-53.8355	-53.1855	-44.5648	-32.0716	-18.2968	-7.8703	-4.5816	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2759.1157	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2789.3691	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	53.3000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	98.3000	(231)
Electricity for lighting (calculated in Appendix L)	233.7398	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-803.1970	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)

Energy used	0.0000	(237)
Total delivered energy for all uses	5077.3276	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2759.1157	0.2100	579.4143	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2789.3691	0.2100	585.7675	(264)
Space and water heating			1165.1818	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	233.7398	0.1443	33.7359	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-451.9520	0.1333	-60.2651	
PV Unit electricity exported	-351.2449	0.1252	-43.9699	
Total			-104.2350	(269)
Total CO2, kg/year			1108.3181	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.6800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2759.1157	1.1300	3117.8007	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2789.3691	1.1300	3151.9871	(278)
Space and water heating			6269.7878	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	233.7398	1.5338	358.5179	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-451.9520	1.4927	-674.6498	
PV Unit electricity exported	-351.2449	0.4595	-161.3876	
Total			-836.0374	(283)
Total Primary energy kWh/year			5940.9766	(286)
Dwelling Primary energy Rate (DPER)			73.3500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	81.0000	(1b) x	2.6000	(2b) =	210.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3925	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3925	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5004	0.4906	0.4808	0.4317	0.4219	0.3728	0.3728	0.3630	0.3925	0.4219	0.4415	0.4611	(22b)
Effective ac	0.6252	0.6203	0.6156	0.5932	0.5890	0.5695	0.5695	0.5659	0.5770	0.5890	0.5975	0.6063	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			17.9100	1.1450	20.5076			(27)
EXTERNAL	79.9200	20.2500	59.6700	0.1800	10.7406			(29a)
External Roof 1	14.8900		14.8900	0.1100	1.6379			(30)
Total net area of external elements Aum(A, m2)			94.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2261			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 167.9495 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.6600	0.0500	0.6330
E3 Sill	7.0000	0.0500	0.3500
E4 Jamb	31.1800	0.0500	1.5590
E7 Party floor between dwellings (in blocks of flats)	48.5600	0.0700	3.3992
E16 Corner (normal)	7.8000	0.0900	0.7020
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000
E14 Flat roof	12.9200	0.0800	1.0336

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9888 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.2149 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4492	43.1114	42.7803	41.2248	40.9338	39.5791	39.5791	39.3283	40.1009	40.9338	41.5225	42.1380	(38)
Heat transfer coeff	86.6642	86.3263	85.9952	84.4398	84.1488	82.7941	82.7941	82.5432	83.3159	84.1488	84.7375	85.3530	(39)
Average = Sum(39)m / 12 =												84.4384	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0699	1.0658	1.0617	1.0425	1.0389	1.0221	1.0221	1.0191	1.0286	1.0389	1.0461	1.0537	(40)
HLP (average)												1.0424	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4816 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	65.8273	64.8381	63.3965	60.6384	58.6030	56.3331	55.0429	56.4735	58.0417	60.4789	63.2963	65.5751	(42a)
Hot water usage for baths	28.4311	28.0089	27.4143	26.3179	25.4970	24.5867	24.0950	24.6855	25.3284	26.3024	27.4213	28.3350	(42b)
Hot water usage for other uses	40.0437	38.5875	37.1314	35.6753	34.2191	32.7630	32.7630	34.2191	35.6753	37.1314	38.5875	40.0437	(42c)
Average daily hot water use (litres/day)												123.4541	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	134.3021	131.4345	127.9422	122.6316	118.3191	113.6828	111.9009	115.3781	119.0454	123.9127	129.3052	133.9538	(44)
Energy conte	212.7018	187.1610	196.6424	167.8766	159.2803	139.7863	135.3345	142.8622	146.7949	168.1484	184.2189	209.7393	(45)
Energy content (annual)										Total = Sum(45)m =		2050.5464	
Distribution loss (46)m = 0.15 x (45)m	31.9053	28.0741	29.4964	25.1815	23.8920	20.9679	20.3002	21.4293	22.0192	25.2223	27.6328	31.4609	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	263.6607	233.1884	247.6013	217.1916	210.2392	189.1014	186.2934	193.8211	196.1099	219.1073	233.5340	260.6982	(62)
WWHRS	-30.0935	-26.6149	-27.8696	-23.0772	-21.5071	-18.4038	-17.2506	-18.3443	-19.0412	-22.4475	-25.4303	-29.5362	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	233.5672	206.5734	219.7317	194.1145	188.7321	170.6976	169.0428	175.4768	177.0687	196.6598	208.1036	231.1620	(64)
									Total per year (kWh/year) = Sum(64)m =			2370.9301	(64)
12Total per year (kWh/year)												2371	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	83.4631	73.7379	78.1233	68.1477	65.7004	58.8077	57.7384	60.2414	61.1381	68.6491	73.5816	82.4780	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.7521	123.7256	111.7521	115.4772	111.7521	115.4772	111.7521	111.7521	115.4772	111.7521	115.4772	111.7521	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.5178	223.8165	218.0239	205.6923	190.1258	175.4954	165.7215	163.4228	169.2154	181.5470	197.1135	211.7439	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	(71)
Water heating gains (Table 5)	112.1815	109.7290	105.0045	94.6496	88.3070	81.6774	77.6054	80.9696	84.9140	92.2703	102.1966	110.8576	(72)
Total internal gains	508.6749	520.4945	498.0040	479.0425	453.4083	432.8734	415.3025	416.3680	429.8300	448.7928	478.0108	497.5770	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

		W/m2	or Table 6b	or Table 6c	Table 6d		
North	3.3700	10.6334	0.6300	0.7000	0.7700	10.9515	(74)
East	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920	(76)
South	9.0900	46.7521	0.6300	0.7000	0.7700	129.8783	(78)
West	0.2700	19.6403	0.6300	0.7000	0.7700	1.6206	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	173.5424	297.6289	411.9016	517.0582	584.4315	582.3087	560.5486	510.1093	448.3687	330.2706	208.2489	148.2578	(83)
Total gains	682.2173	818.1234	909.9056	996.1007	1037.8398	1015.1821	975.8510	926.4773	878.1987	779.0635	686.2597	645.8348	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.6035	43.7742	43.9427	44.7522	44.9069	45.6417	45.6417	45.7804	45.3559	44.9069	44.5950	44.2734	
alpha	3.9069	3.9183	3.9295	3.9835	3.9938	4.0428	4.0428	4.0520	4.0237	3.9938	3.9730	3.9516	
util living area	0.9713	0.9443	0.9006	0.8094	0.6746	0.5032	0.3689	0.4032	0.6080	0.8434	0.9476	0.9760	(86)
MIT	19.5696	19.8735	20.2191	20.6044	20.8485	20.9649	20.9921	20.9887	20.9245	20.5993	20.0325	19.5291	(87)
Th 2	20.0255	20.0289	20.0323	20.0481	20.0511	20.0649	20.0649	20.0675	20.0596	20.0511	20.0451	20.0388	(88)
util rest of house	0.9654	0.9336	0.8820	0.7761	0.6234	0.4361	0.2925	0.3244	0.5391	0.8079	0.9357	0.9711	(89)
MIT 2	18.3781	18.7591	19.1855	19.6518	19.9196	20.0419	20.0615	20.0623	20.0050	19.6600	18.9747	18.3365	(90)
Living area fraction										fLA = Living area / (4) =		0.3457	(91)
MIT	18.7900	19.1444	19.5428	19.9811	20.2407	20.3610	20.3832	20.3825	20.3229	19.9847	19.3404	18.7488	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7900	19.1444	19.5428	19.9811	20.2407	20.3610	20.3832	20.3825	20.3229	19.9847	19.3404	18.7488	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9557	0.9216	0.8711	0.7736	0.6341	0.4578	0.3188	0.3514	0.5591	0.8051	0.9248	0.9623	(94)
Useful gains	651.9739	754.0155	792.5749	770.5698	658.0765	464.7728	311.0688	325.5286	491.0440	627.2563	634.6444	621.4710	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1255.7616	1229.6627	1121.6203	935.6852	718.6876	476.9740	313.2262	328.7309	518.4655	789.7088	1037.2209	1241.7812	(97)
Space heating kWh	449.2181	319.6349	244.8098	118.8831	45.0947	0.0000	0.0000	0.0000	0.0000	120.8646	289.8551	461.5108	(98a)
Space heating requirement - total per year (kWh/year)												2049.8710	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	449.2181	319.6349	244.8098	118.8831	45.0947	0.0000	0.0000	0.0000	0.0000	120.8646	289.8551	461.5108	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2049.8710	
Space heating per m2											(98c) / (4) =	25.3070	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.4000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	449.2181	319.6349	244.8098	118.8831	45.0947	0.0000	0.0000	0.0000	0.0000	120.8646	289.8551	461.5108	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	486.1668	345.9252	264.9457	128.6613	48.8037	0.0000	0.0000	0.0000	0.0000	130.8059	313.6960	499.4705	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	233.5672	206.5734	219.7317	194.1145	188.7321	170.6976	169.0428	175.4768	177.0687	196.6598	208.1036	231.1620	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.7581	85.3131	84.6136	83.3630	81.8266	80.3000	80.3000	80.3000	80.3000	83.3699	85.0915	85.8322	(217)
Fuel for water heating, kWh/month	272.3556	242.1356	259.6884	232.8544	230.6489	212.5748	210.5140	218.5266	220.5090	235.8881	244.5646	269.3184	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.2199	18.6279	16.7723	12.2881	9.4917	7.7548	8.6586	11.2548	14.6189	19.1808	21.6647	23.8652	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.2641	-23.0615	-35.4930	-42.8185	-48.7685	-46.4737	-45.9024	-42.0283	-35.6857	-27.6052	-17.3175	-13.0228	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5025	-9.7576	-19.9433	-30.7839	-41.5376	-42.0502	-41.5626	-34.8107	-25.0182	-14.2269	-6.0963	-3.5400	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2218.4751	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2849.5783	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	187.3978	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-667.2713	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4674.1800	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2218.4751	0.2100	465.8798	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2849.5783	0.2100	598.4115	(264)
Space and water heating			1064.2912	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	187.3978	0.1443	27.0473	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-393.4414	0.1332	-52.3936	
PV Unit electricity exported	-273.8300	0.1251	-34.2563	
Total			-86.6499	(269)
Total CO2, kg/year			1016.6179	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2218.4751	1.1300	2506.8769	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2849.5783	1.1300	3220.0235	(278)
Space and water heating			5726.9004	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	187.3978	1.5338	287.4370	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-393.4414	1.4921	-587.0474	
PV Unit electricity exported	-273.8300	0.4592	-125.7334	
Total			-712.7808	(283)
Total Primary energy kWh/year			5431.6575	(286)
Target Primary Energy Rate (TPER)			67.0600	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 9	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	83 B	**DER**	15.66	**TER**	14.46
Environmental	88 B	**% DER < TER**			-8.30
CO_2 Emissions (t/year)	0.82	**DFEE**	36.06	**TFEE**	32.96
Compliance Check	See BREL	**% DFEE < TFEE**			-9.41
% DPER < TPER	-8.54	**DPER**	84.21	**TPER**	77.58

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	158.6000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3761 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			15.6000	1.1450	17.8626			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1800	6.8742	70.0000	2673.3000	(29a)
External Roof 1	37.4500		37.4500	0.1100	4.1195	9.0000	337.0500	(30)
Total net area of external elements Aum(A, m2)			93.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.6643			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			23.5500			30.0000	706.5000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12059.0500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.6893 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.3000	2.4600
E3 Sill	4.0300	0.0400	0.1612
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	26.9500	0.0700	1.8865
E16 Corner (normal)	7.8000	0.0900	0.7020

E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.7800	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	1.4400	0.1200	0.1728	
E14 Flat roof	16.2300	0.0400	0.6492	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.5207 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 39.1850 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	71.3716	71.1379	70.9089	69.8331	69.6318	68.6948	68.6948	68.5213	69.0557	69.6318	70.0390	70.4647	(39)

Average = Sum(39)m / 12 = 69.8321

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1700	1.1662	1.1624	1.1448	1.1415	1.1261	1.1261	1.1233	1.1321	1.1415	1.1482	1.1552	(40)
HLP (average)												1.1448	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

26.3466	25.9553	25.4043	24.3884	23.6276	22.7841	22.3284	22.8756	23.4714	24.3740	25.4109	26.2576	(42b)

Hot water usage for other uses

37.0652	35.7174	34.3696	33.0218	31.6739	30.3261	30.3261	31.6739	33.0218	34.3696	35.7174	37.0652	(42c)

Average daily hot water use (litres/day) 118.1951 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.5682	125.8499	122.5242	117.4304	113.3071	108.8690	107.1363	110.4473	113.9432	118.6060	123.7793	128.2294	(44)
Energy conte	203.6205	179.2085	188.3151	160.7563	152.5332	133.8672	129.5721	136.7569	140.5033	160.9472	176.3463	200.7763	(45)
Energy content (annual)										Total = Sum(45)m =		1963.2030	
Distribution loss (46)m = 0.15 x (45)m	30.5431	26.8813	28.2473	24.1134	22.8800	20.0801	19.4358	20.5135	21.0755	24.1421	26.4519	30.1164	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	254.5794	225.2359	239.2740	210.0714	203.4921	183.1822	180.5310	187.7158	189.8184	211.9061	225.6614	251.7352	(62)
WWHRS	-50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	204.3391	180.8030	192.7464	171.5447	167.5866	152.4576	151.7316	157.0905	158.0296	174.4305	183.2062	202.4253	(64)
										Total per year (kWh/year) = Sum(64)m =		2096.3912	(64)
12Total per year (kWh/year)												2096	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	80.4436	71.0937	75.3545	65.7802	63.4570	56.8396	55.8224	58.2114	59.0461	66.2547	70.9639	79.4979	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	108.1231	105.7942	101.2829	91.3615	85.2917	78.9439	75.0302	78.2411	82.0085	89.0520	98.5610	106.8520	(72)
Total internal gains	428.2257	437.1991	418.6181	401.8787	380.5290	362.5425	347.9372	349.3274	360.6328	377.4942	402.2831	419.2128	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	540.5282	637.8969	714.1156	796.3586	843.4176	830.0471	795.4425	745.4331	690.8012	605.3364	538.6075	514.0943	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.9338	47.0879	47.2400	47.9678	48.1064	48.7626	48.7626	48.8861	48.5077	48.1064	47.8268	47.5378	
alpha	4.1289	4.1392	4.1493	4.1979	4.2071	4.2508	4.2508	4.2591	4.2338	4.2071	4.1885	4.1692	
util living area	0.9788	0.9587	0.9205	0.8308	0.6893	0.5123	0.3761	0.4165	0.6379	0.8728	0.9607	0.9823	(86)
MIT	19.6103	19.8800	20.2213	20.6134	20.8604	20.9695	20.9935	20.9900	20.9243	20.5868	20.0393	19.5723	(87)
Th 2	19.9441	19.9471	19.9502	19.9644	19.9671	19.9795	19.9795	19.9819	19.9747	19.9671	19.9617	19.9560	(88)
util rest of house	0.9736	0.9490	0.9024	0.7952	0.6322	0.4372	0.2908	0.3273	0.5601	0.8368	0.9499	0.9779	(89)
MIT 2	18.7065	18.9714	19.3006	19.6706	19.8775	19.9654	19.9777	19.9788	19.9351	19.6598	19.1418	18.6783	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	19.0769	19.3438	19.6779	20.0570	20.2803	20.3769	20.3940	20.3932	20.3405	20.0397	19.5096	19.0447	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0769	19.3438	19.6779	20.0570	20.2803	20.3769	20.3940	20.3932	20.3405	20.0397	19.5096	19.0447	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9681	0.9423	0.8969	0.7987	0.6503	0.4670	0.3257	0.3638	0.5891	0.8397	0.9441	0.9730	(94)
Useful gains	523.2891	601.0969	640.5130	636.0338	548.4778	387.6626	259.0964	271.1832	406.9257	508.2951	508.4906	500.2155	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1054.6521	1027.4984	934.4311	779.1266	597.4633	396.8461	260.6273	273.6207	430.9441	657.3049	869.1585	1046.0255	(97)
Space heating kWh	395.3341	286.5418	218.6751	103.0268	36.4452	0.0000	0.0000	0.0000	0.0000	110.8633	259.6809	406.0826	(98a)
Space heating requirement - total per year (kWh/year)												1816.6498	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	395.3341	286.5418	218.6751	103.0268	36.4452	0.0000	0.0000	0.0000	0.0000	110.8633	259.6809	406.0826	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1816.6498	
Space heating per m2											(98c) / (4) =	29.7811	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	395.3341	286.5418	218.6751	103.0268	36.4452	0.0000	0.0000	0.0000	0.0000	110.8633	259.6809	406.0826	(98)
Space heating efficiency (main heating system 1)	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)	476.3061	345.2311	263.4640	124.1287	43.9099	0.0000	0.0000	0.0000	0.0000	133.5702	312.8685	489.2562	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	204.3391	180.8030	192.7464	171.5447	167.5866	152.4576	151.7316	157.0905	158.0296	174.4305	183.2062	202.4253	(64)
Efficiency of water heater												79.4000	(216)
(217)m	84.8677	84.4608	83.7503	82.4224	80.8107	79.4000	79.4000	79.4000	79.4000	82.5343	84.2263	84.9395	(217)
Fuel for water heating, kWh/month	240.7736	214.0673	230.1443	208.1287	207.3818	192.0121	191.0977	197.8470	199.0297	211.3430	217.5167	238.3169	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	21.8087	17.4957	15.7530	11.5413	8.9148	7.2835	8.1324	10.5708	13.7304	18.0151	20.3480	22.4148	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.6043	-20.4515	-31.3194	-37.5924	-42.6571	-40.6099	-40.1392	-36.8522	-31.4116	-24.4338	-15.4091	-11.6196	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.2406	-9.1768	-18.7272	-28.8542	-38.8693	-39.3076	-38.8222	-32.5164	-23.3905	-13.3313	-5.7283	-3.3330	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2188.7347	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2547.6588	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	53.3000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	98.3000	(231)
Electricity for lighting (calculated in Appendix L)	176.0085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-602.3977	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4408.3044	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2188.7347	0.2100	459.6343	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2547.6588	0.2100	535.0084	(264)
Space and water heating			994.6426	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	176.0085	0.1443	25.4035	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-346.1002	0.1333	-46.1201	
PV Unit electricity exported	-256.2976	0.1252	-32.0805	
Total			-78.2006	(269)
Total CO2, kg/year			955.4809	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.6600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2188.7347	1.1300	2473.2702	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2547.6588	1.1300	2878.8545	(278)
Space and water heating			5352.1247	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	176.0085	1.5338	269.9678	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-346.1002	1.4924	-516.5261	
PV Unit electricity exported	-256.2976	0.4594	-117.7487	
Total			-634.2748	(283)
Total Primary energy kWh/year			5136.5260	(286)
Dwelling Primary energy Rate (DPER)			84.2100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			12.9100	1.1450	14.7824			(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584			(29a)
External Roof 1	37.4500		37.4500	0.1100	4.1195			(30)
Total net area of external elements Aum(A, m2)			93.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.6003			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.5500 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100
E3 Sill	4.0300	0.0500	0.2015
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	26.9500	0.0700	1.8865
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680
E18 Party wall between dwellings	10.4000	0.0600	0.6240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.7800	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	1.4400	0.1200	0.1728
E14 Flat roof	16.2300	0.0800	1.2984

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1602 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 34.7605 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	66.9471	66.7135	66.4844	65.4086	65.2073	64.2703	64.2703	64.0968	64.6312	65.2073	65.6145	66.0402	(39)

Average = Sum(39)m / 12 = 65.4076

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0975	1.0937	1.0899	1.0723	1.0690	1.0536	1.0536	1.0508	1.0595	1.0690	1.0756	1.0826	(40)
HLP (average)												1.0723	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)
Hot water usage for baths	25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)
Hot water usage for other uses	35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 108.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.1691	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	238.0923	210.6907	223.9644	197.0124	191.0935	172.2990	169.2359	176.6483	178.4640	198.8945	211.3894	235.4858	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
									Total per year (kWh/year) = Sum(64)m =			2157.2560	(64)
12Total per year (kWh/year)												2157	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	74.9616	66.2574	70.2641	61.4381	59.3345	53.2209	52.1320	54.5314	55.2708	61.9283	66.2185	74.0949	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	100.7548	98.5973	94.4409	85.3307	79.7506	73.9179	70.0699	73.2949	76.7650	83.2370	91.9701	99.5899	(72)
Total internal gains	421.0597	430.2262	411.9783	396.0569	375.1902	357.7256	343.1791	344.5834	355.5982	371.8814	395.9012	412.1530	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1200	10.6334	0.6300	0.7000	0.7700	6.8894	(74)
East	7.0400	19.6403	0.6300	0.7000	0.7700	42.2563	(76)
South	3.7500	46.7521	0.6300	0.7000	0.7700	53.5801	(78)

Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	523.7855	613.8049	682.2621	756.8684	798.5671	785.3233	752.4852	706.8799	657.5911	580.2867	520.5996	498.9440	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.0127	51.1914	51.3677	52.2126	52.3738	53.1373	53.1373	53.2812	52.8406	52.3738	52.0487	51.7132	
alpha	4.4008	4.4128	4.4245	4.4808	4.4916	4.5425	4.5425	4.5521	4.5227	4.4916	4.4699	4.4475	
util living area	0.9808	0.9619	0.9252	0.8353	0.6913	0.5102	0.3730	0.4125	0.6355	0.8754	0.9633	0.9841	(86)
MIT	19.7316	19.9839	20.3003	20.6640	20.8851	20.9774	20.9956	20.9931	20.9406	20.6406	20.1341	19.6976	(87)
Th 2	20.0029	20.0060	20.0091	20.0235	20.0263	20.0389	20.0389	20.0412	20.0340	20.0263	20.0208	20.0150	(88)
util rest of house	0.9761	0.9529	0.9081	0.8011	0.6362	0.4388	0.2929	0.3287	0.5609	0.8406	0.9531	0.9801	(89)
MIT 2	18.5484	18.8662	19.2575	19.6951	19.9316	20.0254	20.0373	20.0385	19.9941	19.6824	19.0692	18.5143	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	19.0333	19.3243	19.6849	20.0922	20.3224	20.4156	20.4300	20.4297	20.3820	20.0751	19.5057	18.9992	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0333	19.3243	19.6849	20.0922	20.3224	20.4156	20.4300	20.4297	20.3820	20.0751	19.5057	18.9992	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9701	0.9454	0.9016	0.8037	0.6536	0.4672	0.3257	0.3630	0.5887	0.8426	0.9465	0.9747	(94)
Useful gains	508.1157	580.3033	615.1212	608.2706	521.9726	366.9375	245.1203	256.6112	387.1546	488.9385	492.7350	486.3425	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	986.3534	962.2920	876.5901	732.0635	562.2444	373.7674	246.1570	258.2936	406.0140	617.8469	813.9924	977.3441	(97)
Space heating kWh	355.8088	256.6964	194.5328	89.1309	29.9623	0.0000	0.0000	0.0000	0.0000	95.9079	231.3053	365.3052	(98a)
Space heating requirement - total per year (kWh/year)												1618.6496	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	355.8088	256.6964	194.5328	89.1309	29.9623	0.0000	0.0000	0.0000	0.0000	95.9079	231.3053	365.3052	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1618.6496	
Space heating per m2											(98c) / (4) =	26.5352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	355.8088	256.6964	194.5328	89.1309	29.9623	0.0000	0.0000	0.0000	0.0000	95.9079	231.3053	365.3052	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	385.0745	277.8100	210.5334	96.4620	32.4267	0.0000	0.0000	0.0000	0.0000	103.7964	250.3304	395.3520	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.4856	85.0575	84.3280	82.9918	81.4682	80.3000	80.3000	80.3000	80.3000	83.1032	84.8152	85.5602	(217)
Fuel for water heating, kWh/month	247.5448	220.1737	236.5097	212.9229	211.3351	194.4045	191.8535	199.8860	201.3836	215.5688	222.8553	244.8556	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1751.7853	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2599.2935	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4083.3018	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1751.7853	0.2100	367.8749	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2599.2935	0.2100	545.8516	(264)
Space and water heating			913.7265	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			881.8490	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.4600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1751.7853	1.1300	1979.5174	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2599.2935	1.1300	2937.2016	(278)
Space and water heating			4916.7191	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4732.4813	(286)
Target Primary Energy Rate (TPER)			77.5800	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 10	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	83 B	**DER**	17.88	**TER**	15.91
Environmental	88 B	**% DER < TER**			-12.38
CO_2 Emissions (t/year)	0.78	**DFEE**	40.07	**TFEE**	34.39
Compliance Check	See BREL	**% DFEE < TFEE**			-16.50
% DPER < TPER	-12.20	**DPER**	96.07	**TPER**	85.62

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

			Area		Storey height		Volume	
Main dwelling			(m2)		(m)		(m3)	
Ground floor			50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		50.0000						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1538 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.4038 (18)
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.4038 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			16.3200	1.1450	18.6870			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1800	5.7258	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1700	1.3974	70.0000	575.4000	(29a)
External Roof 1	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000	(30)
Total net area of external elements Aum(A, m2)			71.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.0592			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			36.9000			30.0000	1107.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8797.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		175.9440 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3000	0.3000	3.0900
E3 Sill	6.6300	0.0400	0.2652
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	35.1600	0.0700	2.4612

E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000	
E14 Flat roof	9.9800	0.0400	0.3992	
P4 Party wall - Roof (insulation at ceiling level)	1.5100	0.1200	0.1812	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3198 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.3790 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	65.5160	65.2951	65.0787	64.0620	63.8718	62.9863	62.9863	62.8223	63.3273	63.8718	64.2566	64.6589	(39)
Average = Sum(39)m / 12 =												64.0611	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3103	1.3059	1.3016	1.2812	1.2774	1.2597	1.2597	1.2564	1.2665	1.2774	1.2851	1.2932	(40)
HLP (average)												1.2812	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)
Hot water usage for baths	23.9204	23.5652	23.0649	22.1425	21.4518	20.6860	20.2723	20.7691	21.3099	22.1294	23.0709	23.8396	(42b)
Hot water usage for other uses	33.6193	32.3968	31.1742	29.9517	28.7292	27.5067	27.5067	28.7292	29.9517	31.1742	32.3968	33.6193	(42c)
Average daily hot water use (litres/day)												107.2537	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	116.6663	114.1999	111.1824	106.5601	102.8186	98.7914	97.2188	100.2231	103.3951	107.6263	112.3208	116.3589	(44)
Energy conte	184.7709	162.6192	170.8831	145.8754	138.4136	121.4756	117.5778	124.0972	127.4966	146.0478	160.0215	182.1899	(45)
Energy content (annual)											Total = Sum(45)m =	1781.4685	
Distribution loss (46)m = 0.15 x (45)m	27.7156	24.3929	25.6325	21.8813	20.7620	18.2213	17.6367	18.6146	19.1245	21.9072	24.0032	27.3285	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.7190	49.5417	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	235.7298	208.6466	221.8420	195.1905	189.3725	170.1946	167.1194	175.0561	176.8116	197.0067	209.3366	233.1488	(62)
WWHRS	-45.5909	-40.3210	-42.2218	-34.9613	-32.5827	-27.8812	-26.1342	-27.7911	-28.8470	-34.0074	-38.5263	-44.7466	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	190.1389	168.3256	179.6202	160.2291	156.7898	142.3134	140.9852	147.2650	147.9646	162.9993	170.8103	188.4021	(64)
										Total per year (kWh/year) = Sum(64)m =		1955.8435	(64)
12Total per year (kWh/year)												1956	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	74.1760	65.5777	69.5584	60.8323	58.7623	52.5704	51.4800	54.0020	54.7214	61.3006	65.5359	73.3179	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	99.6990	97.5859	93.4924	84.4894	78.9815	73.0144	69.1936	72.5834	76.0019	82.3933	91.0221	98.5455	(72)
Total internal gains	372.5470	379.9185	364.0183	349.2942	330.9646	314.7487	301.9561	303.8181	313.5621	328.6744	350.1251	364.8972	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	505.7804	616.0553	705.9105	795.2556	844.2319	828.5815	795.6964	747.8637	692.1942	595.2670	511.5178	477.6724	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.2988	37.4249	37.5494	38.1453	38.2589	38.7968	38.7968	38.8981	38.5879	38.2589	38.0298	37.7932	
alpha	3.4866	3.4950	3.5033	3.5430	3.5506	3.5865	3.5865	3.5932	3.5725	3.5506	3.5353	3.5195	
util living area	0.9623	0.9297	0.8751	0.7698	0.6286	0.4669	0.3431	0.3785	0.5800	0.8209	0.9353	0.9681	(86)
MIT	19.3620	19.7083	20.1193	20.5576	20.8279	20.9558	20.9887	20.9839	20.9034	20.5228	19.8750	19.3111	(87)
Th 2	20.3448	20.3470	20.3492	20.3594	20.3613	20.3701	20.3701	20.3718	20.3667	20.3613	20.3574	20.3534	(88)
util rest of house	0.9579	0.9220	0.8620	0.7477	0.5963	0.4255	0.2957	0.3293	0.5369	0.7979	0.9269	0.9644	(89)
MIT 2	18.8167	19.1577	19.5580	19.9807	20.2260	20.3405	20.3642	20.3629	20.2981	19.9578	19.3329	18.7729	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	19.1003	19.4440	19.8499	20.2806	20.5390	20.6604	20.6889	20.6858	20.6128	20.2516	19.6148	19.0528	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1003	19.4440	19.8499	20.2806	20.5390	20.6604	20.6889	20.6858	20.6128	20.2516	19.6148	19.0528	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9477	0.9097	0.8509	0.7448	0.6055	0.4448	0.3198	0.3541	0.5541	0.7937	0.9156	0.9551	(94)
Useful gains	479.3366	560.4129	600.6283	592.3297	511.1952	368.5704	254.4804	264.8190	383.5142	472.4592	468.3697	456.2058	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	969.6534	949.6516	868.7924	729.0670	564.5627	381.7236	257.5459	269.2460	412.4413	616.4668	804.1588	960.3630	(97)
Space heating kWh	364.7957	261.5684	199.5141	98.4509	39.7055	0.0000	0.0000	0.0000	0.0000	107.1417	241.7682	375.0929	(98a)
Space heating requirement - total per year (kWh/year)												1688.0373	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	364.7957	261.5684	199.5141	98.4509	39.7055	0.0000	0.0000	0.0000	0.0000	107.1417	241.7682	375.0929	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1688.0373	
Space heating per m2											(98c) / (4) =	33.7607	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	364.7957	261.5684	199.5141	98.4509	39.7055	0.0000	0.0000	0.0000	0.0000	107.1417	241.7682	375.0929	(98)
Space heating efficiency (main heating system 1)	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)	439.5128	315.1426	240.3784	118.6155	47.8379	0.0000	0.0000	0.0000	0.0000	129.0864	291.2870	451.9192	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	190.1389	168.3256	179.6202	160.2291	156.7898	142.3134	140.9852	147.2650	147.9646	162.9993	170.8103	188.4021	(64)
Efficiency of water heater												79.4000	(216)
(217)m	84.8511	84.4198	83.7047	82.4673	80.9995	79.4000	79.4000	79.4000	79.4000	82.6016	84.2233	84.9246	(217)
Fuel for water heating, kWh/month	224.0854	199.3912	214.5879	194.2942	193.5688	179.2360	177.5632	185.4722	186.3534	197.3318	202.8065	221.8465	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.4563	14.0041	12.6091	9.2380	7.1357	5.8299	6.5094	8.4612	10.9902	14.4198	16.2871	17.9414	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.2797	-16.9770	-26.0331	-31.2964	-35.5642	-33.8839	-33.4954	-30.7272	-26.1535	-20.3048	-12.7842	-9.6323	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4720	-7.5158	-15.3387	-23.6328	-31.8309	-32.1812	-31.7794	-26.6175	-19.1496	-10.9143	-4.6895	-2.7285	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2033.7799	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2376.5372	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	140.8820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-497.9821	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4139.2169	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2033.7799	0.2100	427.0938	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2376.5372	0.2100	499.0728	(264)
Space and water heating			926.1666	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	140.8820	0.1443	20.3336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.1317	0.1332	-38.3860	
PV Unit electricity exported	-209.8504	0.1252	-26.2678	
Total			-64.6538	(269)
Total CO2, kg/year			893.7756	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			17.8800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2033.7799	1.1300	2298.1713	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2376.5372	1.1300	2685.4870	(278)
Space and water heating			4983.6582	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	140.8820	1.5338	216.0894	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.1317	1.4923	-429.9774	
PV Unit electricity exported	-209.8504	0.4594	-96.4139	
Total			-526.3914	(283)
Total Primary energy kWh/year			4803.4571	(286)
Dwelling Primary energy Rate (DPER)			96.0700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			10.1500	1.1450	11.6221			(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
External Roof 1	13.1000		13.1000	0.1100	1.4410			(30)
Total net area of external elements Aum(A, m2)			71.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.7191			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3240 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	35.1600	0.0700	2.4612
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000
E14 Flat roof	9.9800	0.0800	0.7984
P4 Party wall - Roof (insulation at ceiling level)	1.5100	0.1200	0.1812

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.2103 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 29.9294 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	57.0664	56.8456	56.6291	55.6124	55.4222	54.5367	54.5367	54.3727	54.8778	55.4222	55.8070	56.2093	(39)

Average = Sum(39)m / 12 = 55.6115

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1413	1.1369	1.1326	1.1122	1.1084	1.0907	1.0907	1.0875	1.0976	1.1084	1.1161	1.1242	(40)
HLP (average)												1.1122	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
										Total per year (kWh/year) = Sum(64)m =		1992.9475	(64)
12Total per year (kWh/year)												1993	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557	(72)
Total internal gains	366.2732	373.8444	358.2220	343.8889	325.4004	309.2388	296.7585	298.3915	308.3807	323.6261	344.5705	358.7198	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7800	19.6403	0.6300	0.7000	0.7700	34.6934	(76)
South	3.7000	46.7521	0.6300	0.7000	0.7700	52.8657	(78)
West	0.6700	19.6403	0.6300	0.7000	0.7700	4.0216	(80)

Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	457.8540	536.1596	593.2344	650.4414	678.2217	662.4500	636.1575	603.6283	568.6491	506.8768	455.5074	436.2380	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6176	44.7910	44.9622	45.7842	45.9413	46.6872	46.6872	46.8280	46.3971	45.9413	45.6245	45.2980	
alpha	3.9745	3.9861	3.9975	4.0523	4.0628	4.1125	4.1125	4.1219	4.0931	4.0628	4.0416	4.0199	
util living area	0.9710	0.9472	0.9058	0.8154	0.6803	0.5083	0.3729	0.4079	0.6177	0.8504	0.9485	0.9754	(86)
MIT	19.6160	19.8899	20.2259	20.6094	20.8518	20.9661	20.9925	20.9892	20.9246	20.6013	20.0590	19.5820	(87)
Th 2	19.9672	19.9708	19.9743	19.9908	19.9939	20.0084	20.0084	20.0111	20.0028	19.9939	19.9877	19.9811	(88)
util rest of house	0.9646	0.9360	0.8863	0.7802	0.6255	0.4362	0.2909	0.3231	0.5437	0.8131	0.9357	0.9698	(89)
MIT 2	18.3869	18.7301	19.1440	19.6064	19.8692	19.9873	20.0055	20.0065	19.9507	19.6120	18.9582	18.3540	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	19.0260	19.3332	19.7066	20.1280	20.3801	20.4963	20.5187	20.5175	20.4572	20.1265	19.5306	18.9926	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0260	19.3332	19.7066	20.1280	20.3801	20.4963	20.5187	20.5175	20.4572	20.1265	19.5306	18.9926	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9572	0.9278	0.8806	0.7854	0.6473	0.4723	0.3334	0.3670	0.5785	0.8185	0.9287	0.9630	(94)
Useful gains	438.2485	497.4346	522.3777	510.8325	439.0426	312.8782	212.1082	221.5031	328.9615	414.8758	423.0426	420.0928	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	840.3608	820.4625	747.8760	624.4160	481.0723	321.5639	213.7132	223.8796	348.8662	527.9775	693.7135	831.4806	(97)
Space heating kWh	299.1715	217.0748	167.7707	81.7801	31.2701	0.0000	0.0000	0.0000	0.0000	84.1477	194.8830	306.0725	(98a)
Space heating requirement - total per year (kWh/year)												1382.1705	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	299.1715	217.0748	167.7707	81.7801	31.2701	0.0000	0.0000	0.0000	0.0000	84.1477	194.8830	306.0725	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1382.1705	
Space heating per m2											(98c) / (4) =	27.6434	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	299.1715	217.0748	167.7707	81.7801	31.2701	0.0000	0.0000	0.0000	0.0000	84.1477	194.8830	306.0725	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	323.7787	234.9294	181.5700	88.5066	33.8421	0.0000	0.0000	0.0000	0.0000	91.0689	210.9124	331.2473	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.2767	84.8541	84.1645	82.9720	81.6033	80.3000	80.3000	80.3000	80.3000	82.9929	84.5994	85.3449	(217)
Fuel for water heating, kWh/month	230.7099	205.2915	220.6373	197.5141	193.7757	176.4186	174.0932	182.2506	185.3789	200.8962	208.1362	228.2755	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	1495.8555	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2403.3777	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3698.5604	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1495.8555	0.2100	314.1297	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2403.3777	0.2100	504.7093	(264)
Space and water heating			818.8390	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			795.3288	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.9100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1495.8555	1.1300	1690.3167	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2403.3777	1.1300	2715.8168	(278)
Space and water heating			4406.1335	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4280.9411	(286)
Target Primary Energy Rate (TPER)			85.6200	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 11	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	13.19	**TER**	12.08
Environmental	88 B	**% DER < TER**			-9.19
CO_2 Emissions (t/year)	1.17	**DFEE**	38.40	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			-8.99
% DPER < TPER	-9.67	**DPER**	70.54	**TPER**	64.32

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	104.0000	(1b)	x 2.6000	(2b) =	270.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	270.4000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0740 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3240 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3240 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4131	0.4050	0.3969	0.3564	0.3483	0.3078	0.3078	0.2997	0.3240	0.3483	0.3645	0.3807	(22b)
Effective ac	0.5853	0.5820	0.5787	0.5635	0.5606	0.5474	0.5474	0.5449	0.5525	0.5606	0.5664	0.5725	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			30.4700	1.1450	34.8893			(27)
EXTERNAL	107.7200	32.8100	74.9100	0.1800	13.4838	70.0000	5243.7000	(29a)
HALLWAY	8.2200		8.2200	0.1700	1.3974	70.0000	575.4000	(29a)
External Roof 1	37.7500		37.7500	0.1100	4.1525	9.0000	339.7500	(30)
Total net area of external elements Aum(A, m2)			153.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.7310			(33)
Main dwelling								
Party Floor 1			104.0000			40.0000	4160.0000	(32d)
Party Ceiling 1			66.2500			30.0000	1987.5000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12306.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		118.3303 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.0800	0.3000	4.2240
E3 Sill	7.8000	0.0400	0.3120
E4 Jamb	29.9400	0.0500	1.4970
E7 Party floor between dwellings (in blocks of flats)	63.2200	0.0700	4.4254
E16 Corner (normal)	10.4000	0.0900	0.9360

E18 Party wall between dwellings	2.6000	0.0600	0.1560	
E14 Flat roof	25.9400	0.0400	1.0376	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				12.3540 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	69.0850 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.2281	51.9325	51.6428	50.2819	50.0273	48.8420	48.8420	48.6225	49.2986	50.0273	50.5424	51.0809	(38)
Heat transfer coeff	121.3131	121.0175	120.7278	119.3669	119.1123	117.9270	117.9270	117.7075	118.3836	119.1123	119.6274	120.1659	(39)
Average = Sum(39)m / 12 =												119.3657	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1665	1.1636	1.1608	1.1478	1.1453	1.1339	1.1339	1.1318	1.1383	1.1453	1.1503	1.1554	(40)
HLP (average)												1.1477	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7736 (42)
Hot water usage for mixer showers	79.5644	78.3687	76.6263	73.2926	70.8324	68.0889	66.5294	68.2586	70.1541	73.0999	76.5052	79.2596 (42a)
Hot water usage for baths	32.1440	31.6666	30.9944	29.7549	28.8267	27.7976	27.2417	27.9092	28.6361	29.7373	31.0023	32.0354 (42b)
Hot water usage for other uses	45.2994	43.6521	42.0049	40.3576	38.7104	37.0631	37.0631	38.7104	40.3576	42.0049	43.6521	45.2994 (42c)
Average daily hot water use (litres/day)												144.3395 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	157.0078	153.6875	149.6256	143.4051	138.3695	132.9496	130.8342	134.8782	139.1478	144.8420	151.1596	156.5943	(44)
Energy conte	248.6620	218.8489	229.9690	196.3144	186.2720	163.4770	158.2326	167.0074	171.5831	196.5493	215.3546	245.1888	(45)
Energy content (annual)										Total = Sum(45)m =		2397.4592	
Distribution loss (46)m = 0.15 x (45)m	37.2993	32.8273	34.4953	29.4472	27.9408	24.5215	23.7349	25.0511	25.7375	29.4824	32.3032	36.7783	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	299.6209	264.8763	280.9279	245.6295	237.2309	212.7921	209.1915	217.9663	220.8982	247.5082	264.6697	296.1477	(62)
WWHRS	-61.3500	-54.2584	-56.8163	-47.0462	-43.8453	-37.5188	-35.1679	-37.3975	-38.8184	-45.7626	-51.8434	-60.2139	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	238.2709	210.6179	224.1116	198.5834	193.3856	175.2733	174.0237	180.5688	182.0798	201.7456	212.8263	235.9338	(64)
										Total per year (kWh/year) = Sum(64)m =		2427.4206	(64)
12Total per year (kWh/year)												2427	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	95.4198	84.2741	89.2044	77.6033	74.6752	66.6849	65.3521	68.2697	69.3802	78.0924	83.9342	94.2650	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.4701	146.6634	132.4701	136.8858	132.4701	136.8858	132.4701	132.4701	136.8858	132.4701	136.8858	132.4701	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)
Water heating gains (Table 5)	128.2525	125.4079	119.8984	107.7824	100.3698	92.6179	87.8388	91.7603	96.3613	104.9629	116.5753	126.7003	(72)
Total internal gains	590.9634	605.0374	578.4669	556.1459	525.8616	502.1793	481.3963	482.5925	498.4769	520.2835	554.7676	577.8230	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	13.8400	19.6403	0.5700	0.7000	0.7700	75.1605	(76)
South	11.7700	46.7521	0.5700	0.7000	0.7700	152.1540	(78)
West	0.3600	19.6403	0.5700	0.7000	0.7700	1.9550	(80)

Solar gains	242.5005	425.3284	608.8236	790.0984	910.8610	913.8620	877.2030	786.8322	672.1846	477.8736	292.8304	205.9211	(83)
Total gains	833.4639	1030.3658	1187.2905	1346.2443	1436.7226	1416.0412	1358.5992	1269.4247	1170.6615	998.1571	847.5980	783.7441	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.1786	28.2474	28.3152	28.6380	28.6992	28.9877	28.9877	29.0417	28.8759	28.6992	28.5756	28.4476	
alpha	2.8786	2.8832	2.8877	2.9092	2.9133	2.9325	2.9325	2.9361	2.9251	2.9133	2.9050	2.8965	
util living area	0.9528	0.9180	0.8654	0.7697	0.6414	0.4901	0.3676	0.4058	0.6005	0.8185	0.9254	0.9595	(86)
MIT	18.8358	19.2371	19.7273	20.2788	20.6706	20.8921	20.9654	20.9532	20.7981	20.2541	19.4487	18.7666	(87)
Th 2	19.9469	19.9492	19.9515	19.9620	19.9640	19.9732	19.9732	19.9749	19.9697	19.9640	19.9600	19.9558	(88)
util rest of house	0.9453	0.9056	0.8454	0.7369	0.5923	0.4231	0.2871	0.3227	0.5333	0.7842	0.9119	0.9529	(89)
MIT 2	17.9961	18.3874	18.8598	19.3818	19.7281	19.9118	19.9595	19.9552	19.8447	19.3757	18.6083	17.9346	(90)
Living area fraction									fLA = Living area / (4) =			0.2885	(91)
MIT	18.2383	18.6325	19.1100	19.6405	20.0000	20.1946	20.2497	20.2430	20.1197	19.6291	18.8507	18.1746	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2383	18.6325	19.1100	19.6405	20.0000	20.1946	20.2497	20.2430	20.1197	19.6291	18.8507	18.1746	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9293	0.8865	0.8267	0.7257	0.5941	0.4380	0.3093	0.3451	0.5437	0.7715	0.8940	0.9382	(94)
Useful gains	774.5169	913.4166	981.5478	977.0310	853.5809	620.2734	420.1798	438.0363	636.5023	770.1132	757.7308	735.2782	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1690.8958	1661.8740	1522.3823	1282.0646	988.6324	659.7555	430.3936	452.3557	712.6342	1075.4774	1405.7081	1679.2659	(97)
Space heating kWh	681.7859	502.9634	402.3808	219.6242	100.4783	0.0000	0.0000	0.0000	0.0000	227.1910	466.5437	702.3269	(98a)
Space heating requirement - total per year (kWh/year)												3303.2941	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	681.7859	502.9634	402.3808	219.6242	100.4783	0.0000	0.0000	0.0000	0.0000	227.1910	466.5437	702.3269	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3303.2941	
Space heating per m2											(98c) / (4) =	31.7624	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	681.7859	502.9634	402.3808	219.6242	100.4783	0.0000	0.0000	0.0000	0.0000	227.1910	466.5437	702.3269	(98)
Space heating efficiency (main heating system 1)	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)	821.4288	605.9800	484.7961	264.6075	121.0582	0.0000	0.0000	0.0000	0.0000	273.7241	562.1008	846.1769	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	238.2709	210.6179	224.1116	198.5834	193.3856	175.2733	174.0237	180.5688	182.0798	201.7456	212.8263	235.9338	(64)
Efficiency of water heater												79.4000	(216)
(217)m	85.5989	85.2739	84.7175	83.6954	82.1449	79.4000	79.4000	79.4000	79.4000	83.7343	85.1121	85.6668	(217)
Fuel for water heating, kWh/month	278.3573	246.9899	264.5397	237.2691	235.4201	220.7472	219.1734	227.4166	229.3197	240.9355	250.0542	275.4088	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	35.4793	28.4628	25.6276	18.7759	14.5030	11.8491	13.2301	17.1970	22.3373	29.3077	33.1030	36.4654	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-22.7123	-33.8631	-51.4144	-61.1354	-68.8227	-65.2769	-64.4915	-59.4709	-51.0862	-40.1957	-25.6209	-19.4277	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-7.7430	-16.7027	-33.9986	-52.2668	-70.3157	-71.1156	-70.2694	-58.9181	-42.4428	-24.2568	-10.4537	-6.0914	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3979.8725	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.4000	
Water heating fuel used	2925.6316	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	53.3000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	98.3000	(231)
Electricity for lighting (calculated in Appendix L)	286.3381	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1028.0921	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)

Energy used	0.0000	(237)
Total delivered energy for all uses	6262.0500	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3979.8725	0.2100	835.7732	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2925.6316	0.2100	614.3826	(264)
Space and water heating			1450.1558	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	286.3381	0.1443	41.3274	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-563.5176	0.1334	-75.2007	
PV Unit electricity exported	-464.5745	0.1252	-58.1737	
Total			-133.3744	(269)
Total CO2, kg/year			1371.7443	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.1900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3979.8725	1.1300	4497.2559	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2925.6316	1.1300	3305.9637	(278)
Space and water heating			7803.2196	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	286.3381	1.5338	439.1949	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-563.5176	1.4931	-841.4102	
PV Unit electricity exported	-464.5745	0.4596	-213.5219	
Total			-1054.9322	(283)
Total Primary energy kWh/year			7336.1905	(286)
Dwelling Primary energy Rate (DPER)			70.5400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	104.0000 (1b)	x	2.6000 (2b)	=	270.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	270.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1479	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3979	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3979	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5074	0.4974	0.4875	0.4377	0.4278	0.3780	0.3780	0.3681	0.3979	0.4278	0.4477	0.4676	(22b)
Effective ac	0.6287	0.6237	0.6188	0.5958	0.5915	0.5715	0.5715	0.5677	0.5792	0.5915	0.6002	0.6093	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			23.6600	1.1450	27.0916			(27)
EXTERNAL	107.7200	26.0000	81.7200	0.1800	14.7096			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
External Roof 1	37.7500		37.7500	0.1100	4.1525			(30)
Total net area of external elements Aum(A, m2)			153.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7733			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 124.7005 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.0800	0.0500	0.7040
E3 Sill	7.8000	0.0500	0.3900
E4 Jamb	29.9400	0.0500	1.4970
E7 Party floor between dwellings (in blocks of flats)	63.2200	0.0700	4.4254
E16 Corner (normal)	10.4000	0.0900	0.9360
E18 Party wall between dwellings	2.6000	0.0600	0.1560
E14 Flat roof	25.9400	0.0800	2.0752
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9496 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.7229 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1008	55.6548	55.2177	53.1644	52.7803	50.9920	50.9920	50.6608	51.6808	52.7803	53.5574	54.3699	(38)
Heat transfer coeff	115.8237	115.3777	114.9406	112.8873	112.5032	110.7149	110.7149	110.3837	111.4037	112.5032	113.2803	114.0928	(39)
Average = Sum(39)m / 12 =												112.8855	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1137	1.1094	1.1052	1.0855	1.0818	1.0646	1.0646	1.0614	1.0712	1.0818	1.0892	1.0970	(40)
HLP (average)												1.0854	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7736 (42)

Hot water usage for mixer showers

70.7239	69.6611	68.1123	65.1490	62.9622	60.5234	59.1373	60.6743	62.3592	64.9777	68.0046	70.4529	(42a)

Hot water usage for baths

30.5368	30.0833	29.4447	28.2671	27.3854	26.4077	25.8796	26.5138	27.2043	28.2504	29.4522	30.4336	(42b)

Hot water usage for other uses

43.0344	41.4695	39.9046	38.3398	36.7749	35.2100	35.2100	36.7749	38.3398	39.9046	41.4695	43.0344	(42c)

Average daily hot water use (litres/day) 132.6397 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.2951	141.2139	137.4616	131.7559	127.1224	122.1411	120.2268	123.9629	127.9032	133.1327	138.9264	143.9209	(44)
Energy conte	228.5282	201.0867	211.2734	180.3672	171.1312	150.1867	145.4039	153.4920	157.7174	180.6599	197.9261	225.3454	(45)
Energy content (annual)										Total = Sum(45)m =		2203.1181	

Distribution loss (46)m = 0.15 x (45)m

34.2792	30.1630	31.6910	27.0551	25.6697	22.5280	21.8106	23.0238	23.6576	27.0990	29.6889	33.8018	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

279.4871	247.1141	262.2323	229.6823	222.0901	199.5018	196.3628	204.4509	207.0325	231.6188	247.2411	276.3043	(62)

WWHRS	-32.3320	-28.5947	-29.9427	-24.7938	-23.1069	-19.7727	-18.5338	-19.7088	-20.4576	-24.1173	-27.3220	-31.7333	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

247.1551	218.5194	232.2895	204.8885	198.9832	179.7291	177.8290	184.7421	186.5749	207.5015	219.9192	244.5710	(64)

Total per year (kWh/year) = Sum(64)m = 2502.7025 (64)

12Total per year (kWh/year) 2503 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

88.7254	78.3682	82.9881	72.3009	69.6409	62.2659	61.0865	63.7758	64.7698	72.8091	78.1392	87.6671	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.4429	146.6332	132.4429	136.8577	132.4429	136.8577	132.4429	132.4429	136.8577	132.4429	136.8577	132.4429	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)
Water heating gains (Table 5)	119.2545	116.6193	111.5432	100.4179	93.6033	86.4804	82.1055	85.7202	89.9581	97.8617	108.5266	117.8321	(72)
Total internal gains	581.9383	596.2187	570.0845	548.7532	519.0679	496.0136	475.6358	476.5251	492.0456	513.1552	546.6909	568.9276	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

North				3.4900	10.6334	0.6300	0.7000	0.7700				11.3415	(74)
East				10.7500	19.6403	0.6300	0.7000	0.7700				64.5249	(76)
South				9.1400	46.7521	0.6300	0.7000	0.7700				130.5927	(78)
West				0.2800	19.6403	0.6300	0.7000	0.7700				1.6806	(80)
Solar gains	208.1397	365.0634	522.5593	678.1439	781.7862	784.3571	752.8952	675.3376	576.9414	410.1639	251.3386	176.7431	(83)
Total gains	790.0780	961.2822	1092.6438	1226.8971	1300.8541	1280.3708	1228.5310	1151.8627	1068.9870	923.3190	798.0295	745.6708	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.1030	31.2232	31.3419	31.9120	32.0209	32.5381	32.5381	32.6358	32.3370	32.0209	31.8013	31.5748	
alpha	3.0735	3.0815	3.0895	3.1275	3.1347	3.1692	3.1692	3.1757	3.1558	3.1347	3.1201	3.1050	
util living area	0.9612	0.9320	0.8863	0.7967	0.6703	0.5120	0.3835	0.4219	0.6234	0.8392	0.9370	0.9667	(86)
MIT	18.9722	19.3380	19.7918	20.3237	20.6962	20.9071	20.9719	20.9618	20.8212	20.3113	19.5621	18.9253	(87)
Th 2	19.9897	19.9932	19.9966	20.0127	20.0158	20.0299	20.0299	20.0325	20.0244	20.0158	20.0096	20.0032	(88)
util rest of house	0.9548	0.9212	0.8685	0.7661	0.6226	0.4458	0.3039	0.3401	0.5578	0.8074	0.9252	0.9612	(89)
MIT 2	17.6356	18.0951	18.6591	19.3099	19.7348	19.9616	20.0155	20.0116	19.8815	19.3140	18.3939	17.5849	(90)
Living area fraction										fLA = Living area / (4) =		0.2885	(91)
MIT	18.0212	18.4536	18.9858	19.6024	20.0121	20.2344	20.2914	20.2857	20.1525	19.6017	18.7309	17.9716	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0212	18.4536	18.9858	19.6024	20.0121	20.2344	20.2914	20.2857	20.1525	19.6017	18.7309	17.9716	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9377	0.9003	0.8471	0.7519	0.6224	0.4603	0.3258	0.3621	0.5670	0.7920	0.9055	0.9455	(94)
Useful gains	740.8511	865.4465	925.5446	922.4536	809.6766	589.3322	400.2713	417.0432	606.0770	731.2251	722.6397	705.0401	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1589.2341	1563.7882	1435.1268	1208.1614	935.1399	623.8088	408.6915	428.9199	674.2758	1012.7147	1317.5470	1571.2373	(97)
Space heating kWh	631.1970	469.2856	379.1291	205.7096	93.3447	0.0000	0.0000	0.0000	0.0000	209.4282	428.3333	644.4507	(98a)
Space heating requirement - total per year (kWh/year)												3060.8783	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	631.1970	469.2856	379.1291	205.7096	93.3447	0.0000	0.0000	0.0000	0.0000	209.4282	428.3333	644.4507	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3060.8783	
Space heating per m2											(98c) / (4) =	29.4315	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	631.1970	469.2856	379.1291	205.7096	93.3447	0.0000	0.0000	0.0000	0.0000	209.4282	428.3333	644.4507	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	683.1136	507.8849	410.3129	222.6294	101.0224	0.0000	0.0000	0.0000	0.0000	226.6539	463.5642	697.4575	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.1551	218.5194	232.2895	204.8885	198.9832	179.7291	177.8290	184.7421	186.5749	207.5015	219.9192	244.5710	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.2993	85.9746	85.4242	84.3900	82.8595	80.3000	80.3000	80.3000	80.3000	84.4013	85.7832	86.3557	(217)
Fuel for water heating, kWh/month	286.3930	254.1673	271.9247	242.7876	240.1453	223.8220	221.4558	230.0648	232.3473	245.8511	256.3661	283.2135	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	27.5190	22.0768	19.8777	14.5633	11.2491	9.1906	10.2618	13.3387	17.3256	22.7321	25.6759	28.2839	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.3586	-29.1164	-44.6094	-53.5582	-60.7608	-57.8006	-57.0753	-52.3660	-44.6319	-34.7316	-21.9134	-16.5294	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-6.0208	-13.0217	-26.5680	-40.9436	-55.1878	-55.8598	-55.2254	-46.2916	-33.3089	-18.9788	-8.1487	-4.7365	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3312.6388	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	2988.5386	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	222.0943	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-856.7434	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5752.5282	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3312.6388	0.2100	695.6541	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2988.5386	0.2100	627.5931	(264)
Space and water heating			1323.2472	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	222.0943	0.1443	32.0551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.4518	0.1333	-65.6268	
PV Unit electricity exported	-364.2917	0.1251	-45.5875	
Total			-111.2143	(269)
Total CO2, kg/year			1256.0173	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.0800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3312.6388	1.1300	3743.2818	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2988.5386	1.1300	3377.0486	(278)
Space and water heating			7120.3304	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	222.0943	1.5338	340.6556	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.4518	1.4925	-734.9602	
PV Unit electricity exported	-364.2917	0.4593	-167.3237	
Total			-902.2839	(283)
Total Primary energy kWh/year			6688.8029	(286)
Target Primary Energy Rate (TPER)			64.3200	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Baseline - Flat 12	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	81 B	**DER**	18.65	**TER**	16.64
Environmental	86 B	**% DER < TER**			-12.08
CO_2 Emissions (t/year)	1.04	**DFEE**	49.87	**TFEE**	44.47
Compliance Check	See BREL	**% DFEE < TFEE**			-12.13
% DPER < TPER	-12.26	**DPER**	100.26	**TPER**	89.31

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	64.0000	(1b)	x 2.6000	(2b) =	166.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.4000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1202 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3702 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3702 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4720	0.4627	0.4535	0.4072	0.3980	0.3517	0.3517	0.3424	0.3702	0.3980	0.4165	0.4350	(22b)
Effective ac	0.6114	0.6071	0.6028	0.5829	0.5792	0.5618	0.5618	0.5586	0.5685	0.5792	0.5867	0.5946	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	1.2000	2.8080			(26)
WINDOWS			22.4300	1.1450	25.6832			(27)
EXTERNAL	91.8700	24.7700	67.1000	0.1800	12.0780	70.0000	4697.0000	(29a)
HALLWAY	9.7700		9.7700	0.1700	1.6609	70.0000	683.9000	(29a)
External Roof 1	64.0000		64.0000	0.1100	7.0400	9.0000	576.0000	(30)
Total net area of external elements Aum(A, m2)			165.6400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.2701			(33)
Main dwelling								
Party Floor 1			64.0000			40.0000	2560.0000	(32d)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		8516.9000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							133.0766	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.4000	0.3000	3.7200
E3 Sill	3.8000	0.0400	0.1520
E4 Jamb	29.0400	0.0500	1.4520
E7 Party floor between dwellings (in blocks of flats)	36.3000	0.0700	2.5410
E16 Corner (normal)	14.0000	0.0900	1.2600
E18 Party wall between dwellings	2.8000	0.0600	0.1680

E14 Flat roof												36.3000	0.0400	1.4520	
E17 Corner (inverted - internal area greater than external area)												2.8000	-0.0900	-0.2520	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)														10.4930	(36)
Point Thermal bridges													(36a) =	0.0000	
Total fabric heat loss												(33) + (36) + (36a) =		59.7631	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.5726	33.3351	33.1023	32.0088	31.8042	30.8518	30.8518	30.6754	31.2186	31.8042	32.2181	32.6508	(38)
Heat transfer coeff	93.3357	93.0982	92.8654	91.7719	91.5673	90.6149	90.6149	90.4385	90.9817	91.5673	91.9812	92.4139	(39)
Average = Sum(39)m / 12 =												91.7709	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4584	1.4547	1.4510	1.4339	1.4307	1.4159	1.4159	1.4131	1.4216	1.4307	1.4372	1.4440	(40)
HLP (average)												1.4339	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0922	(42)
Hot water usage for mixer showers	66.7109	65.7084	64.2475	61.4524	59.3896	57.0892	55.7817	57.2315	58.8208	61.2907	64.1459	66.4553	(42a)
Hot water usage for baths	26.9722	26.5716	26.0075	24.9674	24.1886	23.3250	22.8586	23.4187	24.0286	24.9527	26.0142	26.8810	(42b)
Hot water usage for other uses	37.9537	36.5736	35.1934	33.8133	32.4332	31.0530	31.0530	32.4332	33.8133	35.1934	36.5736	37.9537	(42c)
Average daily hot water use (litres/day)												121.0161	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.6368	128.8536	125.4485	120.2331	116.0114	111.4673	109.6933	113.0835	116.6628	121.4369	126.7337	131.2900	(44)
Energy conte	208.4805	183.4858	192.8096	164.5931	156.1736	137.0621	132.6646	140.0209	143.8569	164.7887	180.5554	205.5685	(45)
Energy content (annual)										Total = Sum(45)m =		2010.0597	
Distribution loss (46)m = 0.15 x (45)m	31.2721	27.5229	28.9214	24.6890	23.4260	20.5593	19.8997	21.0031	21.5785	24.7183	27.0833	30.8353	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	259.4395	229.5132	243.7685	213.9082	207.1325	186.3772	183.6235	190.9799	193.1719	215.7476	229.8704	256.5274	(62)
WWHRS	-51.4390	-45.4931	-47.6378	-39.4459	-36.7622	-31.4577	-29.4866	-31.3560	-32.5473	-38.3697	-43.4682	-50.4865	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	208.0004	184.0201	196.1308	174.4622	170.3703	154.9195	154.1369	159.6239	160.6246	177.3779	186.4022	206.0409	(64)
										Total per year (kWh/year) = Sum(64)m =		2132.1097	(64)
12Total per year (kWh/year)												2132	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	82.0595	72.5159	76.8489	67.0560	64.6675	57.9019	56.8507	59.2967	60.1612	67.5320	72.3634	81.0912	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.2575	102.1422	92.2575	95.3327	92.2575	95.3327	92.2575	92.2575	95.3327	92.2575	95.3327	92.2575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	110.2950	107.9105	103.2916	93.1333	86.9186	80.4193	76.4122	79.6999	83.5572	90.7688	100.5048	108.9936	(72)
Total internal gains	442.8460	452.2442	432.9575	415.6921	393.5487	375.0441	359.8913	361.2808	372.9964	390.3152	415.9800	433.4740	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.3600	10.6334	0.5700	0.7000	0.7700	1.0585	(74)
East	16.9500	19.6403	0.5700	0.7000	0.7700	92.0499	(76)
West	5.1200	19.6403	0.5700	0.7000	0.7700	27.8050	(80)

Solar gains	120.9134	236.4844	389.5621	568.6612	697.5867	714.4526	680.0414	583.6578	453.2119	280.6163	150.7507	99.4452	(83)
Total gains	563.7594	688.7286	822.5196	984.3532	1091.1354	1089.4967	1039.9327	944.9386	826.2083	670.9315	566.7307	532.9193	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.3473	25.4119	25.4756	25.7792	25.8368	26.1084	26.1084	26.1593	26.0031	25.8368	25.7205	25.6001	

alpha	2.6898	2.6941	2.6984	2.7186	2.7225	2.7406	2.7406	2.7440	2.7335	2.7225	2.7147	2.7067	
util living area	0.9576	0.9295	0.8773	0.7735	0.6356	0.4835	0.3658	0.4131	0.6255	0.8437	0.9357	0.9629	(86)
MIT	18.5139	18.9026	19.4720	20.1427	20.6116	20.8687	20.9549	20.9365	20.7266	20.0506	19.1639	18.4541	(87)
Th 2	19.7189	19.7217	19.7244	19.7374	19.7398	19.7512	19.7512	19.7533	19.7468	19.7398	19.7349	19.7298	(88)
util rest of house	0.9495	0.9166	0.8551	0.7348	0.5769	0.4034	0.2688	0.3112	0.5445	0.8063	0.9216	0.9558	(89)
MIT 2	17.5134	17.8932	18.4416	19.0713	19.4776	19.6839	19.7363	19.7305	19.5895	19.0124	18.1648	17.4621	(90)
Living area fraction										fLA = Living area / (4) =		0.4062	(91)
MIT	17.9199	18.3033	18.8602	19.5066	19.9383	20.1652	20.2313	20.2204	20.0514	19.4341	18.5707	17.8651	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9199	18.3033	18.8602	19.5066	19.9383	20.1652	20.2313	20.2204	20.0514	19.4341	18.5707	17.8651	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9343	0.8983	0.8372	0.7270	0.5868	0.4310	0.3071	0.3506	0.5657	0.7956	0.9049	0.9417	(94)
Useful gains	526.6998	618.7022	688.6376	715.5983	640.2359	469.5377	319.3174	331.3230	467.3881	533.7868	512.8344	501.8351	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1271.2227	1247.8222	1147.8336	973.3837	754.3559	504.2892	329.0539	345.5143	541.4714	808.9171	1055.0890	1262.8476	(97)
Space heating kWh	553.9250	422.7687	341.6418	185.6055	84.9053	0.0000	0.0000	0.0000	0.0000	204.6969	390.4233	566.1933	(98a)
Space heating requirement - total per year (kWh/year)												2750.1599	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	553.9250	422.7687	341.6418	185.6055	84.9053	0.0000	0.0000	0.0000	0.0000	204.6969	390.4233	566.1933	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2750.1599	
Space heating per m2											(98c) / (4) =	42.9712	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	553.9250	422.7687	341.6418	185.6055	84.9053	0.0000	0.0000	0.0000	0.0000	204.6969	390.4233	566.1933	(98)
Space heating efficiency (main heating system 1)	83.0000	83.0000	83.0000	83.0000	83.0000	0.0000	0.0000	0.0000	0.0000	83.0000	83.0000	83.0000	(210)
Space heating fuel (main heating system)	667.3796	509.3598	411.6166	223.6211	102.2955	0.0000	0.0000	0.0000	0.0000	246.6228	470.3896	682.1606	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	208.0004	184.0201	196.1308	174.4622	170.3703	154.9195	154.1369	159.6239	160.6246	177.3779	186.4022	206.0409	(64)
Efficiency of water heater												79.4000	(216)
(217)m	85.4727	85.2013	84.6559	83.6120	82.0676	79.4000	79.4000	79.4000	79.4000	83.7869	85.0240	85.5283	(217)
Fuel for water heating, kWh/month	243.3530	215.9826	231.6800	208.6568	207.5977	195.1127	194.1271	201.0376	202.2980	211.7013	219.2347	240.9037	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	22.9597	18.4192	16.5844	12.1504	9.3854	7.6679	8.5616	11.1287	14.4551	18.9659	21.4219	23.5979	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.3041	-21.4891	-32.8848	-39.4400	-44.7229	-42.5624	-42.0670	-38.6366	-32.9547	-25.6591	-16.1963	-12.2188	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.4925	-9.7195	-19.8310	-30.5504	-41.1515	-41.6174	-41.1057	-34.4316	-24.7702	-14.1202	-6.0685	-3.5312	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3313.4457	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.4000	
Water heating fuel used												2571.6853	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												53.3000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												98.3000	(231)
Electricity for lighting (calculated in Appendix L)												185.2982	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-634.5256	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5534.2036	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3313.4457	0.2100	695.8236	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2571.6853	0.2100	540.0539	(264)
Space and water heating			1235.8775	(265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354	(267)
Energy for lighting	185.2982	0.1443	26.7443	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1359	0.1333	-48.3962	
PV Unit electricity exported	-271.3897	0.1252	-33.9703	
Total			-82.3665	(269)
Total CO2, kg/year			1193.8907	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			18.6500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3313.4457	1.1300	3744.1936	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2571.6853	1.1300	2906.0044	(278)
Space and water heating			6650.1980	(279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082	(281)
Energy for lighting	185.2982	1.5338	284.2166	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-363.1359	1.4925	-541.9728	
PV Unit electricity exported	-271.3897	0.4594	-124.6849	
Total			-666.6577	(283)
Total Primary energy kWh/year			6416.4652	(286)
Dwelling Primary energy Rate (DPER)			100.2600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	64.0000	(1b)	x 2.6000	(2b) =	166.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	166.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1202	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3702	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3702	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4720	0.4627	0.4535	0.4072	0.3980	0.3517	0.3517	0.3424	0.3702	0.3980	0.4165	0.4350	(22b)
Effective ac	0.6114	0.6071	0.6028	0.5829	0.5792	0.5618	0.5618	0.5586	0.5685	0.5792	0.5867	0.5946	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)

TER Opening Type			13.6600	1.1450	15.6412		(27)
EXTERNAL	91.8700	16.0000	75.8700	0.1800	13.6566		(29a)
HALLWAY	9.7700		9.7700	0.1800	1.7586		(29a)
External Roof 1	64.0000		64.0000	0.1100	7.0400		(30)
Total net area of external elements Aum(A, m2)			165.6400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.4364		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 133.0766 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.4000	0.0500	0.6200
E3 Sill	3.8000	0.0500	0.1900
E4 Jamb	29.0400	0.0500	1.4520
E7 Party floor between dwellings (in blocks of flats)	36.3000	0.0700	2.5410
E16 Corner (normal)	14.0000	0.0900	1.2600
E18 Party wall between dwellings	2.8000	0.0600	0.1680
E14 Flat roof	36.3000	0.0800	2.9040
E17 Corner (inverted - internal area greater than external area)	2.8000	-0.0900	-0.2520

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8830 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 49.3194 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.5726	33.3351	33.1023	32.0088	31.8042	30.8518	30.8518	30.6754	31.2186	31.8042	32.2181	32.6508	(38)
Heat transfer coeff	82.8921	82.6545	82.4217	81.3282	81.1236	80.1712	80.1712	79.9948	80.5381	81.1236	81.5375	81.9702	(39)
Average = Sum(39)m / 12 =												81.3272	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2952	1.2915	1.2878	1.2708	1.2676	1.2527	1.2527	1.2499	1.2584	1.2676	1.2740	1.2808	(40)
HLP (average)												1.2707	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0922 (42)

Hot water usage for mixer showers

59.2986	58.4075	57.1089	54.6243	52.7908	50.7460	49.5837	50.8725	52.2852	54.4806	57.0186	59.0714	(42a)

Hot water usage for baths

25.6236	25.2430	24.7071	23.7191	22.9792	22.1588	21.7157	22.2478	22.8272	23.7051	24.7135	25.5369	(42b)

Hot water usage for other uses

36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)

Average daily hot water use (litres/day) 111.2066 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.9782	118.3954	115.2498	110.4660	106.5815	102.4052	100.7998	103.9318	107.2350	111.6195	116.4770	120.6644	(44)
Energy conte	191.5999	168.5935	177.1346	151.2224	143.4791	125.9191	121.9086	128.6893	132.2315	151.4666	165.9428	188.9313	(45)
Energy content (annual)										Total = Sum(45)m =		1847.1187	
Distribution loss (46)m = 0.15 x (45)m	28.7400	25.2890	26.5702	22.6834	21.5219	18.8879	18.2863	19.3034	19.8347	22.7200	24.8914	28.3397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	242.5588	214.6208	228.0936	200.5375	194.4380	175.2342	172.8675	179.6482	181.5466	202.4255	215.2579	239.8902	(62)
WWHRS	-27.1088	-23.9753	-25.1055	-20.7884	-19.3740	-16.5785	-15.5397	-16.5249	-17.1527	-20.2212	-22.9082	-26.6068	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	215.4500	190.6456	202.9880	179.7491	175.0640	158.6557	157.3278	163.1233	164.3939	182.2043	192.3497	213.2833	(64)
										Total per year (kWh/year) = Sum(64)m =		2195.2347	(64)
12Total per year (kWh/year)												2195	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	76.4467	67.5642	71.6370	62.6102	60.4465	54.1969	53.2743	55.5289	56.2957	63.1024	67.5047	75.5594	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.4146	102.3162	92.4146	95.4951	92.4146	95.4951	92.4146	92.4146	95.4951	92.4146	95.4951	92.4146	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	102.7509	100.5419	96.2863	86.9587	81.2453	75.2734	71.6053	74.6356	78.1885	84.8150	93.7566	101.5583	(72)
Total internal gains	435.4591	445.0497	426.1094	409.6799	388.0325	370.0606	355.2415	356.3738	367.7902	384.5186	409.3942	426.1959	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.2200	10.6334	0.6300	0.7000	0.7700	0.7149	(74)

East			10.3200		19.6403		0.6300		0.7000		0.7700		61.9439 (76)
West			3.1200		19.6403		0.6300		0.7000		0.7700		18.7272 (80)
Solar gains	81.3861	159.1762	262.2121	382.7639	469.5449	480.8981	457.7356	392.8586	305.0548	188.8812	101.4694	66.9361	(83)
Total gains	516.8452	604.2259	688.3216	792.4438	857.5774	850.9587	812.9771	749.2325	672.8450	573.3998	510.8637	493.1320	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.5408	28.6228	28.7037	29.0896	29.1630	29.5094	29.5094	29.5745	29.3750	29.1630	29.0149	28.8618	
alpha	2.9027	2.9082	2.9136	2.9393	2.9442	2.9673	2.9673	2.9716	2.9583	2.9442	2.9343	2.9241	
util living area	0.9633	0.9424	0.9039	0.8205	0.6969	0.5413	0.4125	0.4590	0.6721	0.8686	0.9446	0.9676	(86)
MIT	18.7392	19.0563	19.5358	20.1426	20.5969	20.8646	20.9551	20.9378	20.7334	20.1116	19.3303	18.6954	(87)
Th 2	19.8446	19.8475	19.8504	19.8638	19.8663	19.8781	19.8781	19.8803	19.8736	19.8663	19.8612	19.8559	(88)
util rest of house	0.9565	0.9320	0.8864	0.7883	0.6438	0.4637	0.3155	0.3590	0.5980	0.8371	0.9328	0.9615	(89)
MIT 2	17.2455	17.6449	18.2428	18.9842	19.5024	19.7835	19.8572	19.8491	19.6664	18.9703	18.0045	17.1971	(90)
Living area fraction										fLA = Living area / (4) =		0.4062	(91)
MIT	17.8523	18.2183	18.7681	19.4548	19.9470	20.2227	20.3032	20.2914	20.0998	19.4339	18.5431	17.8058	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8523	18.2183	18.7681	19.4548	19.9470	20.2227	20.3032	20.2914	20.0998	19.4339	18.5431	17.8058	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9128	0.8662	0.7752	0.6479	0.4886	0.3533	0.3971	0.6141	0.8228	0.9148	0.9465	(94)
Useful gains	486.0489	551.5461	596.2084	614.2714	555.6189	415.7942	287.2277	297.4893	413.1826	471.7925	467.3205	466.7600	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1123.3816	1100.8149	1011.1550	858.4028	669.0283	450.7813	296.8920	311.2902	483.2158	716.6415	933.0426	1115.2703	(97)
Space heating kWh	474.1755	369.1086	308.7202	175.7746	84.3766	0.0000	0.0000	0.0000	0.0000	182.1676	335.3199	482.4917	(98a)
Space heating requirement - total per year (kWh/year)												2412.1347	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	474.1755	369.1086	308.7202	175.7746	84.3766	0.0000	0.0000	0.0000	0.0000	182.1676	335.3199	482.4917	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2412.1347	
Space heating per m2											(98c) / (4) =	37.6896	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	474.1755	369.1086	308.7202	175.7746	84.3766	0.0000	0.0000	0.0000	0.0000	182.1676	335.3199	482.4917	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	513.1770	399.4682	334.1128	190.2323	91.3166	0.0000	0.0000	0.0000	0.0000	197.1511	362.9004	522.1771	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	215.4500	190.6456	202.9880	179.7491	175.0640	158.6557	157.3278	163.1233	164.3939	182.2043	192.3497	213.2833	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.0218	85.7714	85.2770	84.3335	82.9084	80.3000	80.3000	80.3000	80.3000	84.3810	85.5597	86.0742	(217)
Fuel for water heating, kWh/month	250.4598	222.2718	238.0336	213.1408	211.1535	197.5787	195.9251	203.1423	204.7246	215.9304	224.8134	247.7901	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	19.2019	15.4045	13.8701	10.1618	7.8493	6.4129	7.1604	9.3073	12.0893	15.8618	17.9158	19.7356	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1522	-18.4106	-28.4154	-34.3859	-39.2668	-37.4668	-37.0165	-33.8482	-28.6683	-22.0910	-13.8073	-10.3630	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4659	-7.5205	-15.3861	-23.7691	-32.0862	-32.4781	-32.0916	-26.8641	-19.2952	-10.9615	-4.6925	-2.7237	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2610.5354	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2624.9640	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	154.9706	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-527.2267	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4949.2434	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2610.5354	0.2100	548.2124	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2624.9640	0.2100	551.2425	(264)
Space and water heating			1099.4549	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	154.9706	0.1443	22.3671	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-315.8921	0.1331	-42.0463	
PV Unit electricity exported	-211.3346	0.1251	-26.4348	
Total			-68.4811	(269)
Total CO2, kg/year			1065.2701	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.6400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2610.5354	1.1300	2949.9050	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2624.9640	1.1300	2966.2094	(278)
Space and water heating			5916.1144	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	154.9706	1.5338	237.6991	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-315.8921	1.4918	-471.2612	
PV Unit electricity exported	-211.3346	0.4591	-97.0257	
Total			-568.2869	(283)
Total Primary energy kWh/year			5715.6274	(286)
Target Primary Energy Rate (TPER)			89.3100	(287)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Shop 1, 13 Bedford Road Baseline

As designed

Date: Wed Feb 26 10:13:12 2025

Administrative information

Building Details

Address: 13 Bedford Road, Wood Green, LONDON, N22 7AU

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 139.02

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	4.85	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	5.4	
Target primary energy rate (TPER), kWh/m^2.annum	52.43	
Building primary energy rate (BPER), kWh/m^2.annum	59.25	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.28	0.28	GF/01 SHOP/East/Wall-External
Floors	0.18	0.15	0.18	GF/02 TOILETS/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.18	0.18	GF/01 SHOP/Roof
Windows** and roof windows	1.6	1.6	1.6	GF/01 SHOP/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3	3	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
GF/02 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF/01 SHOP	247	50	3
GF/02 TOILETS	601	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF/01 SHOP	YES (+13.4%)	NO
GF/02 TOILETS	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	139	139
External area [m^2]	343.6	343.6
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	112.97	123.88
Average U-value [W/m^2K]	0.33	0.36
Alpha value* [%]	20.89	20.88

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	9.58	10.5
Cooling	23.8	8.44
Auxiliary	0.32	0.43
Lighting	15.78	14.36
Hot water	1.65	1.65
Equipment*	20.24	20.24
TOTAL**	**51.14**	**35.39**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	11.87	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*11.87*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	278.94	233.52
Primary energy [kWh/m^2]	59.25	52.43
Total emissions [kg/m^2]	5.4	4.85

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	96.4	182.5	9.6	23.8	0.3	2.8	2.13	3	3
	Notional	99.8	133.7	10.5	8.4	0.4	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Shop 2, 13 Bedford Road Baseline

As designed

Date: Wed Feb 26 10:23:43 2025

Administrative information

Building Details

Address: 13 Bedford Road, Wood Green, LONDON, N22 7AU

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 119.35

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	5.3	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	5.3	
Target primary energy rate (TPER), kWh/m^2.annum	56.91	
Building primary energy rate (BPER), kWh/m^2.annum	57.77	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.28	0.28	GF/01 SHOP/East/Wall-External
Floors	0.18	0.14	0.18	GF/02 TOILETS/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.18	0.18	GF/01 SHOP/Roof
Windows** and roof windows	1.6	1.6	1.6	GF/01 SHOP/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	8

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3	3	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
GF/02 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF/01 SHOP	233	50	3
GF/02 TOILETS	599	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF/01 SHOP	YES (+34%)	NO
GF/02 TOILETS	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	119.4	119.4
External area [m^2]	353.3	353.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	8	3
Average conductance [W/K]	105.42	103.91
Average U-value [W/m^2K]	0.3	0.29
Alpha value* [%]	16.4	17.92

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	12.04	12.78
Cooling	21.76	6.79
Auxiliary	0.38	0.5
Lighting	16.12	16.56
Hot water	1.65	1.65
Equipment*	20.23	20.23
TOTAL**	**51.95**	**38.28**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	13.82	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*13.82*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	288.02	229.07
Primary energy [kWh/m^2]	57.77	56.91
Total emissions [kg/m^2]	5.3	5.3

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	121.1	166.9	12	21.8	0.4	2.8	2.13	3	3
	Notional	121.5	107.6	12.8	6.8	0.5	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

1b. Be Lean SAP/SBEM Calculations

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 1	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	85 B	**DER**	11.06	**TER**	13.59
Environmental	92 A	**% DER < TER**			18.62
CO_2 Emissions (t/year)	0.63	**DFEE**	22.37	**TFEE**	29.08
Compliance Check	See BREL	**% DFEE < TFEE**			23.09
% DPER < TPER	10.54	**DPER**	65.26	**TPER**	72.94

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	158.6000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			15.6000	0.7752	12.0930			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1400	5.3466	70.0000	2673.3000	(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.3116			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			61.0000			30.0000	1830.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12845.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		210.5820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100

E3 Sill	4.0300	0.0400	0.1612	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.7848 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.0964 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.9818	14.7855	14.5892	13.6079	13.4116	12.4303	12.4303	12.2340	12.8228	13.4116	13.8041	14.1967	(38)
Heat transfer coeff	40.0782	39.8819	39.6856	38.7043	38.5080	37.5267	37.5267	37.3304	37.9192	38.5080	38.9006	39.2931	(39)
Average = Sum(39)m / 12 =												38.6552	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6570	0.6538	0.6506	0.6345	0.6313	0.6152	0.6152	0.6120	0.6216	0.6313	0.6377	0.6441	(40)
HLP (average)												0.6337	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)
Hot water usage for mixer showers

65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 115.2889 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.3976	122.7662	119.5355	114.5599	110.5421	106.2135	104.5036	107.7199	111.1185	115.6688	120.7229	125.0633	(44)
Energy conte	198.5991	174.8175	183.7216	156.8267	148.8109	130.6019	126.3880	133.3797	137.0202	156.9614	171.9919	195.8189	(45)
Energy content (annual)										Total = Sum(45)m =		1914.9379	
Distribution loss (46)m = 0.15 x (45)m	29.7899	26.2226	27.5582	23.5240	22.3216	19.5903	18.9582	20.0070	20.5530	23.5442	25.7988	29.3728	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	249.5580	220.8449	234.6805	206.1418	199.7698	179.9170	177.3469	184.3386	186.3353	207.9203	221.3070	246.7778	(62)
WWHRS	-50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	199.3177	176.4120	188.1529	167.6151	163.8643	149.1924	148.5475	153.7133	154.5465	170.4448	178.8518	197.4679	(64)
									Total per year (kWh/year) = Sum(64)m =			2048.1262	(64)
12Total per year (kWh/year)												2048	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month	78.7739	69.6337	73.8272	64.4737	62.2193	55.7539	54.7637	57.0885	57.8880	64.9294	69.5161	77.8495	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	105.8789	103.6215	99.2300	89.5467	83.6281	77.4360	73.6072	76.7318	80.4000	87.2707	96.5501	104.6364	(72)
Total internal gains	425.9816	435.0265	416.5652	400.0640	378.8655	361.0346	346.5142	347.8181	359.0243	375.7129	400.2722	416.9973	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	538.2841	635.7242	712.0628	794.5439	841.7540	828.5391	794.0196	743.9238	689.1927	603.5552	536.5966	511.8787	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	89.0309	89.4690	89.9115	92.1912	92.6610	95.0842	95.0842	95.5841	94.0999	92.6610	91.7260	90.8097	
alpha	6.9354	6.9646	6.9941	7.1461	7.1774	7.3389	7.3389	7.3723	7.2733	7.1774	7.1151	7.0540	
util living area													
	0.9475	0.8788	0.7654	0.5838	0.4249	0.2898	0.2079	0.2308	0.3794	0.6514	0.8801	0.9571	(86)
MIT	20.7764	20.8194	20.8496	20.8669	20.8698	20.8728	20.8728	20.8734	20.8716	20.8659	20.8304	20.7723	(87)
Th 2	20.3790	20.3818	20.3847	20.3991	20.4019	20.4163	20.4163	20.4192	20.4106	20.4019	20.3962	20.3904	(88)
util rest of house													
	0.9378	0.8613	0.7404	0.5562	0.3978	0.2634	0.1804	0.2017	0.3471	0.6171	0.8601	0.9490	(89)
MIT 2	20.1062	20.1598	20.1964	20.2293	20.2349	20.2532	20.2532	20.2568	20.2459	20.2315	20.1878	20.1125	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	20.3809	20.4301	20.4641	20.4906	20.4951	20.5071	20.5071	20.5095	20.5023	20.4915	20.4511	20.3829	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3809	20.4301	20.4641	20.4906	20.4951	20.5071	20.5071	20.5095	20.5023	20.4915	20.4511	20.3829	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9378	0.8628	0.7437	0.5604	0.4020	0.2675	0.1847	0.2062	0.3521	0.6223	0.8620	0.9489	(94)
Useful gains	504.8266	548.4770	529.5772	445.2883	338.3881	221.6650	146.6216	153.4087	242.6925	375.6166	462.5459	485.7056	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	644.4925	619.3703	554.1754	448.6062	338.6822	221.6752	146.6221	153.4098	242.7720	380.9026	519.3672	635.8760	(97)
Space heating kWh													
	103.9114	47.6403	18.3010	2.3889	0.2189	0.0000	0.0000	0.0000	0.0000	3.9328	40.9113	111.7268	(98a)
Space heating requirement - total per year (kWh/year)												329.0313	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	103.9114	47.6403	18.3010	2.3889	0.2189	0.0000	0.0000	0.0000	0.0000	3.9328	40.9113	111.7268	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												329.0313	
Space heating per m2											(98c) / (4) =	5.3940	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												84.1000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	103.9114	47.6403	18.3010	2.3889	0.2189	0.0000	0.0000	0.0000	0.0000	3.9328	40.9113	111.7268	(98)
Space heating efficiency (main heating system 1)													
	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)													
	123.5569	56.6472	21.7610	2.8405	0.2602	0.0000	0.0000	0.0000	0.0000	4.6764	48.6460	132.8499	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.3177	176.4120	188.1529	167.6151	163.8643	149.1924	148.5475	153.7133	154.5465	170.4448	178.8518	197.4679	(64)
Efficiency of water heater												80.5000	(216)
(217)m	83.2537	82.1867	81.1947	80.6093	80.5104	80.5000	80.5000	80.5000	80.5000	80.6756	81.9729	83.4091	(217)
Fuel for water heating, kWh/month													
	239.4100	214.6477	231.7305	207.9351	203.5319	185.3322	184.5311	190.9482	191.9832	211.2718	218.1839	236.7462	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	24.3293	21.9748	24.3293	23.5445	24.3293	23.5445	24.3293	24.3293	23.5445	24.3293	23.5445	24.3293	(231)
Lighting	21.1467	16.9647	15.2748	11.1910	8.6443	7.0624	7.8856	10.2500	13.3137	17.4683	19.7304	21.7345	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												391.2382	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.5000	
Water heating fuel used												2516.2519	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)													
mechanical ventilation fans (SFP = 1.0360)												200.4577	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												286.4577	(231)
Electricity for lighting (calculated in Appendix L)												170.6664	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3364.6142	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	391.2382	0.2100	82.1600	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2516.2519	0.2100	528.4129	(264)
Space and water heating			610.5729	(265)
Pumps, fans and electric keep-hot	286.4577	0.1387	39.7352	(267)
Energy for lighting	170.6664	0.1443	24.6324	(268)
Total CO2, kg/year			674.9406	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.0600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	391.2382	1.1300	442.0992	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2516.2519	1.1300	2843.3647	(278)
Space and water heating			3285.4639	(279)
Pumps, fans and electric keep-hot	286.4577	1.5128	433.3532	(281)
Energy for lighting	170.6664	1.5338	261.7738	(282)
Total Primary energy kWh/year			3980.5909	(286)
Dwelling Primary energy Rate (DPER)			65.2600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b) x	2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		158.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			12.9100	1.1450	14.7824			(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584			(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)

Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 24.4808 (33)

Main dwelling

Party Wall 1	32.7900	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 220.5820 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100
E3 Sill	4.0300	0.0500	0.2015
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680
E18 Party wall between dwellings	10.4000	0.0600	0.6240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8251 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.3059 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	62.4925	62.2589	62.0298	60.9540	60.7527	59.8157	59.8157	59.6422	60.1766	60.7527	61.1599	61.5856	(39)
Average = Sum(39)m / 12 =												60.9530	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0206	1.0169	0.9992	0.9959	0.9806	0.9806	0.9777	0.9865	0.9959	1.0026	1.0096	(40)
HLP (average)												0.9992	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)
Hot water usage for baths	25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)
Hot water usage for other uses	35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)
Average daily hot water use (litres/day)												108.6142	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.1691	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	238.0923	210.6907	223.9644	197.0124	191.0935	172.2990	169.2359	176.6483	178.4640	198.8945	211.3894	235.4858	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
									Total per year (kWh/year) = Sum(64)m =			2157.2560	(64)
12Total per year (kWh/year)												2157	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month	74.9616	66.2574	70.2641	61.4381	59.3345	53.2209	52.1320	54.5314	55.2708	61.9283	66.2185	74.0949	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	100.7548	98.5973	94.4409	85.3307	79.7506	73.9179	70.0699	73.2949	76.7650	83.2370	91.9701	99.5899	(72)
Total internal gains	421.0597	430.2262	411.9783	396.0569	375.1902	357.7256	343.1791	344.5834	355.5982	371.8814	395.9012	412.1530	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1200	10.6334	0.6300	0.7000	0.7700	6.8894	(74)
East	7.0400	19.6403	0.6300	0.7000	0.7700	42.2563	(76)
South	3.7500	46.7521	0.6300	0.7000	0.7700	53.5801	(78)

Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	523.7855	613.8049	682.2621	756.8684	798.5671	785.3233	752.4852	706.8799	657.5911	580.2867	520.5996	498.9440	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8094	60.0339	60.2555	61.3190	61.5222	62.4859	62.4859	62.6677	62.1111	61.5222	61.1126	60.6901	
alpha	4.9873	5.0023	5.0170	5.0879	5.1015	5.1657	5.1657	5.1778	5.1407	5.1015	5.0742	5.0460	
util living area	0.9837	0.9648	0.9255	0.8247	0.6672	0.4813	0.3488	0.3863	0.6081	0.8695	0.9661	0.9868	(86)
MIT	19.9498	20.1841	20.4665	20.7736	20.9356	20.9903	20.9985	20.9975	20.9693	20.7456	20.3068	19.9188	(87)
Th 2	20.0630	20.0662	20.0693	20.0840	20.0867	20.0995	20.0995	20.1019	20.0946	20.0867	20.0811	20.0753	(88)
util rest of house	0.9795	0.9561	0.9079	0.7892	0.6131	0.4162	0.2779	0.3118	0.5370	0.8332	0.9562	0.9833	(89)
MIT 2	18.8590	19.1540	19.5015	19.8675	20.0356	20.0940	20.0990	20.1010	20.0750	19.8486	19.3224	18.8292	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	19.3061	19.5761	19.8970	20.2389	20.4045	20.4613	20.4677	20.4684	20.4415	20.2162	19.7258	19.2757	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3061	19.5761	19.8970	20.2389	20.4045	20.4613	20.4677	20.4684	20.4415	20.2162	19.7258	19.2757	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9506	0.9042	0.7956	0.6325	0.4426	0.3070	0.3424	0.5649	0.8389	0.9515	0.9794	(94)
Useful gains	510.7226	583.4844	616.9180	602.1517	505.0854	347.5679	230.9843	242.0195	371.4902	486.8075	495.3536	488.6494	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	937.7669	913.7201	831.0143	691.1484	528.8210	350.6002	231.3465	242.6483	381.6118	584.2091	772.1955	928.4484	(97)
Space heating kWh	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98a)
Space heating requirement - total per year (kWh/year)												1379.6673	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1379.6673	
Space heating per m2											(98c) / (4) =	22.6175	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	343.8538	240.1715	172.3892	69.3481	19.1118	0.0000	0.0000	0.0000	0.0000	78.4273	215.7210	354.1238	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.2500	84.7461	83.9041	82.4218	81.0292	80.3000	80.3000	80.3000	80.3000	82.6014	84.4955	85.3327	(217)
Fuel for water heating, kWh/month	248.2289	220.9826	237.7048	214.3952	212.4801	194.4045	191.8535	199.8860	201.3836	216.8783	223.6985	245.5085	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1493.1464	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2607.4045	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)

Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3832.7739	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1493.1464	0.2100	313.5607	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2607.4045	0.2100	547.5549	(264)
Space and water heating			861.1157	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			829.2382	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1493.1464	1.1300	1687.2554	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2607.4045	1.1300	2946.3671	(278)
Space and water heating			4633.6225	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4449.3847	(286)
Target Primary Energy Rate (TPER)			72.9400	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 2	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	12.81	**TER**	15.50
Environmental	91 B	**% DER < TER**			17.35
CO_2 Emissions (t/year)	0.59	**DFEE**	25.97	**TFEE**	32.55
Compliance Check	See BREL	**% DFEE < TFEE**			20.22
% DPER < TPER	10.17	**DPER**	74.93	**TPER**	83.41

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	130.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			16.3200	0.7752	12.6512			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1400	4.4534	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			58.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.0452			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9072.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.4460 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150	
E3 Sill	6.6300	0.0400	0.2652	
E4 Jamb	22.8600	0.0500	1.1430	
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8630 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.9082 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.2801	12.1193	11.9584	11.1540	10.9931	10.1887	10.1887	10.0279	10.5105	10.9931	11.3149	11.6366	(38)
Heat transfer coeff	38.1883	38.0274	37.8665	37.0622	36.9013	36.0969	36.0969	35.9360	36.4187	36.9013	37.2230	37.5448	(39)

Average = Sum(39)m / 12 = 37.0219

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7638	0.7605	0.7573	0.7412	0.7380	0.7219	0.7219	0.7187	0.7284	0.7380	0.7445	0.7509	(40)
HLP (average)												0.7404	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 104.6166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7893	111.4018	108.4704	103.9553	100.3096	96.3818	94.8299	97.7482	100.8321	104.9611	109.5474	113.4859	(44)
Energy conte	180.2144	158.6347	166.7150	142.3097	135.0360	118.5126	114.6885	121.0327	124.3360	142.4312	156.0703	177.6915	(45)

Energy content (annual) Total = Sum(45)m = 1737.6727

Distribution loss (46)m = 0.15 x (45)m	27.0322	23.7952	25.0072	21.3465	20.2554	17.7769	17.2033	18.1549	18.6504	21.3647	23.4105	26.6537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	47.5307	48.3243	49.8114	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	231.1733	204.6621	217.6739	191.6247	185.9949	166.0434	163.0128	170.8441	173.6511	193.3901	205.3854	228.6504	(62)
WWHRS	-45.5909	-40.3210	-42.2218	-34.9613	-32.5827	-27.8812	-26.1342	-27.7911	-28.8470	-34.0074	-38.5263	-44.7466	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	185.5824	164.3412	175.4521	156.6634	153.4122	138.1621	136.8786	143.0530	144.8041	159.3826	166.8591	183.9038	(64)

Total per year (kWh/year) = Sum(64)m = 1908.4946 (64)

12Total per year (kWh/year) 1908 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	72.6610	64.2529	68.1724	59.6467	57.6392	51.2881	50.2150	52.6962	53.6705	60.0981	64.2222	71.8222	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	97.6627	95.6144	91.6296	82.8427	77.4720	71.2335	67.4933	70.8283	74.5424	80.7770	89.1974	96.5352	(72)
Total internal gains	370.5107	377.9470	362.1555	347.6476	329.4551	312.9678	300.2558	302.0630	312.1025	327.0581	348.3004	362.8869	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	503.7441	614.0839	704.0477	793.6089	842.7224	826.8006	793.9961	746.1086	690.7346	593.6507	509.6931	475.6621	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	65.9910	66.2702	66.5517	67.9961	68.2926	69.8144	69.8144	70.1269	69.1976	68.2926	67.7022	67.1221	
alpha	5.3994	5.4180	5.4368	5.5331	5.5528	5.6543	5.6543	5.6751	5.6132	5.5528	5.5135	5.4748	
util living area	0.9245	0.8429	0.7242	0.5544	0.4056	0.2793	0.2000	0.2215	0.3630	0.6250	0.8528	0.9375	(86)
MIT	20.6984	20.7571	20.7994	20.8254	20.8314	20.8353	20.8354	20.8360	20.8338	20.8228	20.7687	20.6907	(87)
Th 2	20.2848	20.2877	20.2905	20.3045	20.3074	20.3215	20.3215	20.3243	20.3158	20.3074	20.3017	20.2961	(88)
util rest of house	0.9124	0.8231	0.6975	0.5248	0.3759	0.2497	0.1692	0.1890	0.3273	0.5884	0.8306	0.9271	(89)
MIT 2	19.9183	19.9904	20.0408	20.0828	20.0915	20.1102	20.1103	20.1139	20.1028	20.0837	20.0192	19.9199	(90)
Living area fraction									fLA = Living area / (4) =			0.5200	(91)
MIT	20.3239	20.3891	20.4353	20.4690	20.4762	20.4873	20.4873	20.4894	20.4829	20.4680	20.4089	20.3207	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3239	20.3891	20.4353	20.4690	20.4762	20.4873	20.4873	20.4894	20.4829	20.4680	20.4089	20.3207	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9132	0.8261	0.7031	0.5319	0.3831	0.2569	0.1767	0.1969	0.3360	0.5970	0.8342	0.9275	(94)
Useful gains	459.9954	507.2742	495.0116	422.1158	322.8673	212.4393	140.3144	146.9440	232.1158	354.4164	425.1761	441.1861	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	611.9270	589.0099	527.6808	428.7705	323.8542	212.5122	140.3208	146.9557	232.4575	364.1420	495.3994	605.2487	(97)
Space heating kWh	113.0371	54.9264	24.3058	4.7914	0.7342	0.0000	0.0000	0.0000	0.0000	7.2359	50.5607	122.0626	(98a)
Space heating requirement - total per year (kWh/year)												377.6542	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	113.0371	54.9264	24.3058	4.7914	0.7342	0.0000	0.0000	0.0000	0.0000	7.2359	50.5607	122.0626	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												377.6542	
Space heating per m2										(98c) / (4) =		7.5531	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												84.1000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	113.0371	54.9264	24.3058	4.7914	0.7342	0.0000	0.0000	0.0000	0.0000	7.2359	50.5607	122.0626	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	134.4080	65.3109	28.9011	5.6972	0.8730	0.0000	0.0000	0.0000	0.0000	8.6039	60.1198	145.1398	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	185.5824	164.3412	175.4521	156.6634	153.4122	138.1621	136.8786	143.0530	144.8041	159.3826	166.8591	183.9038	(64)
Efficiency of water heater												80.5000	(216)
(217)m	83.5527	82.4946	81.4567	80.7312	80.5370	80.5000	80.5000	80.5000	80.5000	80.8388	82.3484	83.7239	(217)
Fuel for water heating, kWh/month	222.1142	199.2145	215.3932	194.0555	190.4865	171.6300	170.0355	177.7056	179.8808	197.1610	202.6258	219.6551	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	21.2592	19.2018	21.2592	20.5734	21.2592	20.5734	21.2592	21.2592	20.5734	21.2592	20.5734	21.2592	(231)
Lighting	17.4563	14.0041	12.6091	9.2380	7.1357	5.8299	6.5094	8.4612	10.9902	14.4198	16.2871	17.9414	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												449.0537	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.5000	
Water heating fuel used												2339.9577	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)													
mechanical ventilation fans (SFP = 1.0360)												164.3096	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												250.3096	(231)
Electricity for lighting (calculated in Appendix L)												140.8820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3180.2030	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	449.0537	0.2100	94.3013	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2339.9577	0.2100	491.3911	(264)
Space and water heating			585.6924	(265)
Pumps, fans and electric keep-hot	250.3096	0.1387	34.7210	(267)
Energy for lighting	140.8820	0.1443	20.3336	(268)
Total CO2, kg/year			640.7470	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.8100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	449.0537	1.1300	507.4307	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2339.9577	1.1300	2644.1522	(278)
Space and water heating			3151.5829	(279)
Pumps, fans and electric keep-hot	250.3096	1.5128	378.6684	(281)
Energy for lighting	140.8820	1.5338	216.0894	(282)
Total Primary energy kWh/year			3746.3407	(286)
Dwelling Primary energy Rate (DPER)			74.9300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b) x	2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		130.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			10.1500	1.1450	11.6221			(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)

Total net area of external elements Aum(A, m2) 58.6900 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 22.2781 (33)
Main dwelling
Party Wall 1 15.3900 0.0000 0.0000 (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 191.4460 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9293 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 28.2074 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	55.3444	55.1236	54.9071	53.8904	53.7002	52.8147	52.8147	52.6507	53.1558	53.7002	54.0850	54.4873	(39)
Average = Sum(39)m / 12 =												53.8895	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1069	1.1025	1.0981	1.0778	1.0740	1.0563	1.0563	1.0530	1.0631	1.0740	1.0817	1.0897	(40)
HLP (average)												1.0778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
									Total per year (kWh/year) = Sum(64)m =			1992.9475	(64)
12Total per year (kWh/year)												1993	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557	(72)
Total internal gains	366.2732	373.8444	358.2220	343.8889	325.4004	309.2388	296.7585	298.3915	308.3807	323.6261	344.5705	358.7198	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7800	19.6403	0.6300	0.7000	0.7700	34.6934	(76)
South	3.7000	46.7521	0.6300	0.7000	0.7700	52.8657	(78)
West	0.6700	19.6403	0.6300	0.7000	0.7700	4.0216	(80)

Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	457.8540	536.1596	593.2344	650.4414	678.2217	662.4500	636.1575	603.6283	568.6491	506.8768	455.5074	436.2380	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0441	48.2366	48.4267	49.3404	49.5151	50.3453	50.3453	50.5021	50.0223	49.5151	49.1628	48.7999	
alpha	4.2029	4.2158	4.2284	4.2894	4.3010	4.3564	4.3564	4.3668	4.3348	4.3010	4.2775	4.2533	
util living area	0.9729	0.9490	0.9064	0.8120	0.6715	0.4965	0.3624	0.3967	0.6071	0.8485	0.9502	0.9772	(86)
MIT	19.7280	19.9930	20.3121	20.6685	20.8823	20.9756	20.9950	20.9927	20.9422	20.6563	20.1478	19.6955	(87)
Th 2	19.9952	19.9988	20.0024	20.0190	20.0221	20.0367	20.0367	20.0394	20.0311	20.0221	20.0158	20.0092	(88)
util rest of house	0.9668	0.9380	0.8869	0.7763	0.6170	0.4269	0.2845	0.3160	0.5344	0.8106	0.9376	0.9719	(89)
MIT 2	18.5429	18.8748	19.2671	19.6954	19.9244	20.0218	20.0348	20.0364	19.9919	19.6956	19.0851	18.5122	(90)
Living area fraction									fLA = Living area / (4) =			0.5200	(91)
MIT	19.1592	19.4563	19.8105	20.2014	20.4225	20.5178	20.5341	20.5337	20.4861	20.1951	19.6377	19.1275	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1592	19.4563	19.8105	20.2014	20.4225	20.5178	20.5341	20.5337	20.4861	20.1951	19.6377	19.1275	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9603	0.9309	0.8826	0.7834	0.6400	0.4622	0.3249	0.3579	0.5695	0.8180	0.9318	0.9659	(94)
Useful gains	439.6766	499.1278	523.6068	509.5275	434.0850	306.1732	206.7081	216.0161	323.8422	414.6006	424.4402	421.3812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	822.3718	802.3943	730.8413	609.0395	468.3983	312.5461	207.7794	217.6406	339.4556	515.2610	678.1017	813.3609	(97)
Space heating kWh	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98a)
Space heating requirement - total per year (kWh/year)												1289.0410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1289.0410	
Space heating per m2											(98c) / (4) =	25.7808	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	308.1442	220.5575	166.8642	77.5418	27.6288	0.0000	0.0000	0.0000	0.0000	81.0512	197.6583	315.6200	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.1725	84.7186	83.9856	82.7347	81.3945	80.3000	80.3000	80.3000	80.3000	82.7822	84.4599	85.2437	(217)
Fuel for water heating, kWh/month	230.9921	205.6197	221.1071	198.0806	194.2729	176.4186	174.0932	182.2506	185.3789	201.4076	208.4800	228.5465	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1395.0661	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2406.6478	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)

Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3601.0410	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1395.0661	0.2100	292.9639	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2406.6478	0.2100	505.3960	(264)
Space and water heating			798.3599	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			774.8498	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.5000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1395.0661	1.1300	1576.4247	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2406.6478	1.1300	2719.5120	(278)
Space and water heating			4295.9367	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4170.7442	(286)
Target Primary Energy Rate (TPER)			83.4100	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 3	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	14.16	**TER**	17.71
Environmental	91 B	**% DER < TER**			20.05
CO_2 Emissions (t/year)	0.52	**DFEE**	25.86	**TFEE**	34.69
Compliance Check	See BREL	**% DFEE < TFEE**			25.45
% DPER < TPER	13.82	**DPER**	82.49	**TPER**	95.72

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000 (1b)	x	2.6000 (2b)	=	101.4000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	101.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			7.6400	0.7752	5.9225			(27)
EXTERNAL	36.0400	9.9800	26.0600	0.1400	3.6484	70.0000	1824.2000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		12.5115			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			39.0000			40.0000	1560.0000	(32d)
Party Ceiling 1			39.0000			30.0000	1170.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8958.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		229.6974 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900	
E3 Sill	4.8000	0.0400	0.1920	
E4 Jamb	13.3400	0.0500	0.6670	
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	2.6000	0.0600	0.1560	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1558 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 16.6673 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.5785	9.4530	9.3275	8.7001	8.5746	7.9472	7.9472	7.8217	8.1982	8.5746	8.8256	9.0766	(38)
Heat transfer coeff	26.2458	26.1203	25.9948	25.3674	25.2419	24.6145	24.6145	24.4890	24.8655	25.2419	25.4929	25.7438	(39)
Average = Sum(39)m / 12 =												25.3360	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6730	0.6698	0.6665	0.6504	0.6472	0.6311	0.6311	0.6279	0.6376	0.6472	0.6537	0.6601	(40)
HLP (average)												0.6496	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3800 (42)
Hot water usage for mixer showers

53.2775	52.4768	51.3101	49.0778	47.4304	45.5933	44.5491	45.7069	46.9762	48.9487	51.2290	53.0734	(42a)

Hot water usage for baths

20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)

Hot water usage for other uses

28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)

Average daily hot water use (litres/day) 94.2642 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.5289	100.3780	97.7369	93.6686	90.3837	86.8447	85.4461	88.0754	90.8539	94.5742	98.7067	102.2555	(44)
Energy conte	162.3807	142.9370	150.2179	128.2276	121.6738	106.7856	103.3396	109.0557	112.0319	128.3364	140.6259	160.1074	(45)
Energy content (annual)										Total = Sum(45)m =		1565.7195	
Distribution loss (46)m = 0.15 x (45)m	24.3571	21.4405	22.5327	19.2341	18.2511	16.0178	15.5009	16.3584	16.8048	19.2505	21.0939	24.0161	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	49.8056	46.1927	46.0585	42.8275	43.5424	44.8823	44.8046	48.1940	48.6773	50.9589	(61)
Total heat required for water heating calculated for each month	213.3396	188.9643	200.0236	174.4204	167.7324	149.6131	146.8820	153.9380	156.8365	176.5303	189.3032	211.0663	(62)
WWHRS	-41.0809	-36.3323	-38.0450	-31.5028	-29.3595	-25.1231	-23.5489	-25.0419	-25.9933	-30.6433	-34.7151	-40.3201	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	172.2587	152.6321	161.9786	142.9176	138.3729	124.4900	123.3331	128.8961	130.8432	145.8871	154.5880	170.7462	(64)
										Total per year (kWh/year) = Sum(64)m =		1746.9436	(64)
12Total per year (kWh/year)												1747	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	66.7313	59.0334	62.3989	54.1839	51.9712	46.2131	45.2460	47.4816	48.4518	54.7203	58.9274	65.9754	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.8268	68.4511	61.8268	63.8877	61.8268	63.8877	61.8268	61.8268	63.8877	61.8268	63.8877	61.8268	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	89.6926	87.8473	83.8695	75.2554	69.8537	64.1849	60.8146	63.8193	67.2941	73.5488	81.8436	88.6766	(72)
Total internal gains	317.2466	323.2607	309.5461	296.3668	280.5400	266.0708	255.3878	257.1575	265.8056	279.6255	298.3455	310.9788	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains	41.4903	81.1639	133.6653	194.9429	238.9099	244.5668	232.8375	200.0040	155.4583	96.3078	51.7336	34.1196	(83)
Total gains	358.7369	404.4246	443.2114	491.3097	519.4499	510.6375	488.2253	457.1615	421.2639	375.9333	350.0790	345.0984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	94.8110	95.2665	95.7264	98.0940	98.5816	101.0944	101.0944	101.6124	100.0741	98.5816	97.6111	96.6596	
alpha	7.3207	7.3511	7.3818	7.5396	7.5721	7.7396	7.7396	7.7742	7.6716	7.5721	7.5074	7.4440	
util living area	0.9484	0.8967	0.7987	0.6179	0.4513	0.3085	0.2218	0.2464	0.4070	0.6837	0.8877	0.9558	(86)
MIT	20.7931	20.8262	20.8550	20.8734	20.8765	20.8794	20.8794	20.8799	20.8782	20.8723	20.8403	20.7913	(87)
Th 2	20.3648	20.3676	20.3705	20.3848	20.3877	20.4021	20.4021	20.4049	20.3963	20.3877	20.3819	20.3762	(88)
util rest of house	0.9382	0.8798	0.7733	0.5882	0.4218	0.2797	0.1917	0.2145	0.3715	0.6475	0.8672	0.9468	(89)
MIT 2	20.1128	20.1546	20.1897	20.2235	20.2293	20.2473	20.2473	20.2508	20.2401	20.2257	20.1859	20.1219	(90)
Living area fraction									fLA = Living area / (4) =			0.7436	(91)
MIT	20.6187	20.6540	20.6844	20.7068	20.7105	20.7173	20.7173	20.7186	20.7146	20.7065	20.6725	20.6197	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6187	20.6540	20.6844	20.7068	20.7105	20.7173	20.7173	20.7186	20.7146	20.7065	20.6725	20.6197	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9425	0.8877	0.7862	0.6038	0.4374	0.2949	0.2076	0.2313	0.3903	0.6666	0.8772	0.9505	(94)
Useful gains	338.0932	359.0262	348.4531	296.6654	227.1969	150.5656	101.3447	105.7574	164.4015	250.5921	307.0966	328.0216	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	428.2968	411.4986	368.7207	299.5078	227.4430	150.5739	101.3451	105.7583	164.4752	255.1071	346.0014	422.7052	(97)
Space heating kWh	67.1115	35.2614	15.0791	2.0465	0.1831	0.0000	0.0000	0.0000	0.0000	3.3591	28.0115	70.4446	(98a)
Space heating requirement - total per year (kWh/year)												221.4968	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	67.1115	35.2614	15.0791	2.0465	0.1831	0.0000	0.0000	0.0000	0.0000	3.3591	28.0115	70.4446	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												221.4968	
Space heating per m2											(98c) / (4) =	5.6794	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 84.1000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	67.1115	35.2614	15.0791	2.0465	0.1831	0.0000	0.0000	0.0000	0.0000	3.3591	28.0115	70.4446	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	80.5000	(210)
Space heating fuel (main heating system)	79.7996	41.9280	17.9300	2.4334	0.2178	0.0000	0.0000	0.0000	0.0000	3.9942	33.3074	83.7628	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	172.2587	152.6321	161.9786	142.9176	138.3729	124.4900	123.3331	128.8961	130.8432	145.8871	154.5880	170.7462	(64)
Efficiency of water heater												80.5000	(216)
(217)m	82.7390	81.9851	81.1672	80.6098	80.5103	80.5000	80.5000	80.5000	80.5000	80.6753	81.7099	82.8352	(217)
Fuel for water heating, kWh/month	208.1953	186.1706	199.5616	177.2954	171.8699	154.6460	153.2089	160.1194	162.5381	180.8325	189.1914	206.1276	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.1891	16.4288	18.1891	17.6023	18.1891	17.6023	18.1891	18.1891	17.6023	18.1891	17.6023	18.1891	(231)
Lighting	13.4326	10.7761	9.7027	7.1086	5.4909	4.4861	5.0090	6.5109	8.4570	11.0960	12.5329	13.8059	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 263.3732 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 80.5000
Water heating fuel used 2149.7566 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)
mechanical ventilation fans (SFP = 1.0360) 128.1615 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 214.1615 (231)
Electricity for lighting (calculated in Appendix L) 108.4087 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)
Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2735.6999	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	263.3732	0.2100	55.3084	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2149.7566	0.2100	451.4489	(264)
Space and water heating			506.7572	(265)
Pumps, fans and electric keep-hot	214.1615	0.1387	29.7068	(267)
Energy for lighting	108.4087	0.1443	15.6467	(268)
Total CO2, kg/year			552.1108	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.1600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	263.3732	1.1300	297.6117	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2149.7566	1.1300	2429.2250	(278)
Space and water heating			2726.8366	(279)
Pumps, fans and electric keep-hot	214.1615	1.5128	323.9835	(281)
Energy for lighting	108.4087	1.5338	166.2809	(282)
Total Primary energy kWh/year			3217.1010	(286)
Dwelling Primary energy Rate (DPER)			82.4900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000	(1b) x	2.6000	(2b) =	101.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	101.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1972	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4472	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4472	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5702	0.5590	0.5479	0.4920	0.4808	0.4249	0.4249	0.4137	0.4472	0.4808	0.5031	0.5255	(22b)
Effective ac	0.6626	0.6563	0.6501	0.6210	0.6156	0.5903	0.5903	0.5856	0.6000	0.6156	0.6266	0.6381	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			7.4100	1.1450	8.4847			(27)
EXTERNAL	36.0400	9.7500	26.2900	0.1800	4.7322			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)

Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 17.0365 (33)
Main dwelling
Party Wall 1 21.2700 0.0000 0.0000 (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 239.6974 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900	
E3 Sill	4.8000	0.0500	0.2400	
E4 Jamb	13.3400	0.0500	0.6670	
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	2.6000	0.0600	0.1560	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.2038 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 21.2403 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.1713	21.9600	21.7530	20.7804	20.5984	19.7513	19.7513	19.5944	20.0776	20.5984	20.9665	21.3514	(38)
Heat transfer coeff	43.4116	43.2004	42.9933	42.0207	41.8387	40.9916	40.9916	40.8347	41.3179	41.8387	42.2068	42.5917	(39)
Average = Sum(39)m / 12 =												42.0198	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1131	1.1077	1.1024	1.0775	1.0728	1.0511	1.0511	1.0470	1.0594	1.0728	1.0822	1.0921	(40)
HLP (average)												1.0774	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3800 (42)
Hot water usage for mixer showers

47.3578	46.6461	45.6090	43.6247	42.1604	40.5274	39.5992	40.6284	41.7566	43.5100	45.5369	47.1763	(42a)

Hot water usage for baths

20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)

Hot water usage for other uses

28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)

Average daily hot water use (litres/day) 88.8064 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.6092	94.5473	92.0358	88.2155	85.1137	81.7787	80.4962	82.9968	85.6343	89.1355	93.0146	96.3584	(44)
Energy conte	153.0053	134.6340	141.4555	120.7626	114.5793	100.5565	97.3532	102.7674	105.5956	120.9560	132.5164	150.8740	(45)
Energy content (annual)										Total = Sum(45)m =		1475.0560	
Distribution loss (46)m = 0.15 x (45)m	22.9508	20.1951	21.2183	18.1144	17.1869	15.0835	14.6030	15.4151	15.8393	18.1434	19.8775	22.6311	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	49.2310	43.5176	46.9004	43.5035	43.3730	40.3292	41.0200	42.2943	42.2306	45.4225	45.8702	49.1032	(61)
Total heat required for water heating calculated for each month	202.2362	178.1517	188.3559	164.2662	157.9523	140.8857	138.3732	145.0617	147.8262	166.3785	178.3866	199.9772	(62)
WWHRS	-21.6500	-19.1474	-20.0501	-16.6023	-15.4727	-13.2401	-12.4105	-13.1973	-13.6987	-16.1493	-18.2952	-21.2491	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	180.5863	159.0042	168.3059	147.6639	142.4796	127.6456	125.9627	131.8644	134.1275	150.2292	160.0914	178.7282	(64)
										Total per year (kWh/year) = Sum(64)m =		1806.6889	(64)
12Total per year (kWh/year)												1807	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	63.1820	55.6452	58.7591	51.0295	48.9409	43.5173	42.6249	44.7437	45.6682	51.5735	55.5293	62.4414	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.8308	67.3484	60.8308	62.8585	60.8308	62.8585	60.8308	60.8308	62.8585	60.8308	62.8585	60.8308	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	84.9220	82.8054	78.9772	70.8742	65.7807	60.4408	57.2916	60.1394	63.4281	69.3192	77.1240	83.9266	(72)
Total internal gains	311.4800	317.1160	303.6578	290.9564	275.4710	261.2974	250.8688	252.4815	260.9103	274.3999	292.5966	305.2328	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.7100	19.6403	0.6300	0.7000	0.7700	40.2756	(76)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	44.4772	87.0068	143.2878	208.9768	256.1089	262.1730	249.5994	214.4022	166.6497	103.2409	55.4578	36.5759	(83)

Total gains	355.9571	404.1228	446.9456	499.9332	531.5798	523.4704	500.4682	466.8837	427.5600	377.6408	348.0544	341.8086	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8163	60.1088	60.3983	61.7963	62.0651	63.3476	63.3476	63.5910	62.8474	62.0651	61.5237	60.9678	
alpha	4.9878	5.0073	5.0266	5.1198	5.1377	5.2232	5.2232	5.2394	5.1898	5.1377	5.1016	5.0645	
util living area													
	0.9851	0.9713	0.9386	0.8436	0.6857	0.4943	0.3593	0.4003	0.6373	0.8902	0.9704	0.9875	(86)
MIT	19.9291	20.1322	20.4154	20.7502	20.9290	20.9896	20.9984	20.9972	20.9635	20.7147	20.2836	19.9141	(87)
Th 2	20.4434	20.4461	20.4488	20.4613	20.4636	20.4745	20.4745	20.4765	20.4703	20.4636	20.4589	20.4540	(88)
util rest of house													
	0.9829	0.9671	0.9300	0.8244	0.6544	0.4557	0.3168	0.3555	0.5955	0.8718	0.9655	0.9856	(89)
MIT 2	19.4394	19.6421	19.9211	20.2490	20.4094	20.4679	20.4737	20.4751	20.4455	20.2230	19.8033	19.4331	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	19.8035	20.0065	20.2887	20.6217	20.7958	20.8558	20.8638	20.8633	20.8307	20.5886	20.1605	19.7908	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8035	20.0065	20.2887	20.6217	20.7958	20.8558	20.8638	20.8633	20.8307	20.5886	20.1605	19.7908	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9799	0.9634	0.9272	0.8303	0.6740	0.4838	0.3483	0.3886	0.6242	0.8764	0.9624	0.9829	(94)
Useful gains	348.8055	389.3291	414.4291	415.1003	358.2754	253.2515	174.3139	181.4532	266.8856	330.9488	334.9767	335.9620	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	673.0329	652.6059	592.8209	492.5540	380.5561	256.4363	174.7818	182.2597	278.0978	417.9115	551.2421	664.0384	(97)
Space heating kWh													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98a)
Space heating requirement - total per year (kWh/year)												1087.7143	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1087.7143	
Space heating per m2											(98c) / (4) =	27.8901	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	261.0662	191.4740	143.6402	60.3535	17.9403	0.0000	0.0000	0.0000	0.0000	70.0219	168.5185	264.1654	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5863	159.0042	168.3059	147.6639	142.4796	127.6456	125.9627	131.8644	134.1275	150.2292	160.0914	178.7282	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.0025	84.6108	83.8775	82.4875	81.1178	80.3000	80.3000	80.3000	80.3000	82.7086	84.3220	85.0497	(217)
Fuel for water heating, kWh/month													
	212.4481	187.9242	200.6567	179.0137	175.6452	158.9609	156.8651	164.2147	167.0330	181.6368	189.8573	210.1456	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	12.6394	10.1398	9.1298	6.6889	5.1667	4.2212	4.7132	6.1264	7.9576	10.4408	11.7929	12.9907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.5051	-11.4259	-17.7250	-21.5712	-24.7560	-23.6831	-23.4153	-21.3606	-18.0067	-13.7752	-8.5514	-6.3952	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0121	-4.3759	-8.9665	-13.8670	-18.7247	-18.9396	-18.6975	-15.6360	-11.2211	-6.3662	-2.7219	-1.5795	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1177.1799	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2184.4014	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												102.0075	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-321.2788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3228.3100	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1177.1799	0.2100	247.2078	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2184.4014	0.2100	458.7243	(264)
Space and water heating			705.9321	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	102.0075	0.1443	14.7228	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	0.1330	-26.3533	
PV Unit electricity exported	-123.1080	0.1251	-15.3980	
Total			-41.7513	(269)
Total CO2, kg/year			690.8329	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.7100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1177.1799	1.1300	1330.2133	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2184.4014	1.1300	2468.3736	(278)
Space and water heating			3798.5869	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	102.0075	1.5338	156.4624	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	1.4914	-295.5498	
PV Unit electricity exported	-123.1080	0.4591	-56.5166	
Total			-352.0664	(283)
Total Primary energy kWh/year			3733.0837	(286)
Target Primary Energy Rate (TPER)			95.7200	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 4	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	86 B	**DER**	9.72	**TER**	12.15
Environmental	92 A	**% DER < TER**			20.00
CO_2 Emissions (t/year)	0.76	**DFEE**	24.55	**TFEE**	31.13
Compliance Check	See BREL	**% DFEE < TFEE**			21.14
% DPER < TPER	10.98	**DPER**	57.72	**TPER**	64.84

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	87.0000 (1b)	x	2.6000 (2b)	=	226.2000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.2000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			25.5000	0.7752	19.7674			(27)
EXTERNAL	86.2100	27.8400	58.3700	0.1400	8.1718	70.0000	4085.9000	(29a)
External Roof 1	6.3100		6.3100	0.1000	0.6310	9.0000	56.7900	(30)
Total net area of external elements Aum(A, m2)			92.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4422			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			87.0000			40.0000	3480.0000	(32d)
Party Ceiling 1			80.6900			30.0000	2420.7000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 13871.9900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	159.4482	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130	
E3 Sill	4.8000	0.0400	0.1920	
E4 Jamb	27.9200	0.0500	1.3960	
E7 Party floor between dwellings (in blocks of flats)	58.6100	0.0700	4.1027	
E16 Corner (normal)	10.4000	0.0900	0.9360	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	
E14 Flat roof	7.7100	0.0800	0.6168	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.1685 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 38.6107 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.3674	21.0875	20.8076	19.4080	19.1280	17.7284	17.7284	17.4485	18.2883	19.1280	19.6879	20.2477	(38)
Heat transfer coeff	59.9782	59.6982	59.4183	58.0187	57.7388	56.3392	56.3392	56.0592	56.8990	57.7388	58.2986	58.8585	(39)
Average = Sum(39)m / 12 =												57.9487	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6894	0.6862	0.6830	0.6669	0.6637	0.6476	0.6476	0.6444	0.6540	0.6637	0.6701	0.6765	(40)
HLP (average)												0.6661	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5824 (42)
Hot water usage for mixer showers

75.9577	74.8162	73.1528	69.9702	67.6216	65.0023	63.5136	65.1644	66.9740	69.7862	73.0371	75.6667	(42a)

Hot water usage for baths

29.1581	28.7251	28.1153	26.9909	26.1490	25.2154	24.7112	25.3167	25.9760	26.9750	28.1225	29.0596	(42b)

Hot water usage for other uses

41.0763	39.5826	38.0889	36.5952	35.1015	33.6079	33.6079	35.1015	36.5952	38.0889	39.5826	41.0763	(42c)

Average daily hot water use (litres/day) 134.4067 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1921	143.1239	139.3570	133.5564	128.8721	123.8256	121.8326	125.5826	129.5452	134.8501	140.7422	145.8025	(44)
Energy conte	231.5326	203.8065	214.1865	182.8320	173.4866	152.2581	147.3460	155.4975	159.7422	182.9903	200.5131	228.2915	(45)
Energy content (annual)										Total = Sum(45)m =		2232.4829	
Distribution loss (46)m = 0.15 x (45)m	34.7299	30.5710	32.1280	27.4248	26.0230	22.8387	22.1019	23.3246	23.9613	27.4485	30.0770	34.2437	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	282.4915	249.8339	265.1454	232.1471	224.4455	201.5731	198.3049	206.4564	209.0573	233.9492	249.8282	279.2504	(62)
WWHRS	-58.5690	-51.7989	-54.2408	-44.9135	-41.8578	-35.8180	-33.5737	-35.7022	-37.0587	-43.6881	-49.4933	-57.4844	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	223.9225	198.0350	210.9046	187.2335	182.5877	165.7551	164.7312	170.7542	171.9986	190.2611	200.3349	221.7660	(64)
										Total per year (kWh/year) = Sum(64)m =		2288.2845	(64)
12Total per year (kWh/year)												2288	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.7243	79.2725	83.9567	73.1204	70.4240	62.9546	61.7323	64.4427	65.4431	73.5840	78.9994	88.6466	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.7482	130.3641	117.7482	121.6731	117.7482	121.6731	117.7482	117.7482	121.6731	117.7482	121.6731	117.7482	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.4490	235.8715	229.7669	216.7711	200.3661	184.9478	174.6474	172.2249	178.3295	191.3253	207.7303	223.1486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	(71)
Water heating gains (Table 5)	120.5972	117.9650	112.8451	101.5561	94.6559	87.4369	82.9735	86.6165	90.8931	98.9032	109.7214	119.1487	(72)
Total internal gains	536.5302	548.9365	525.0961	504.7362	477.5061	455.7937	437.1050	438.3255	452.6316	472.7126	503.8607	524.7814	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	10.3800	19.6403	0.5700	0.7000	0.7700	56.3704	(76)
South	9.9000	46.7521	0.5700	0.7000	0.7700	127.9800	(78)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains	201.4914	352.8046	504.1560	653.9998	754.5250	757.4660	726.8775	651.4412	556.4242	396.0935	243.1846	171.1882	(83)
Total gains	738.0216	901.7411	1029.2521	1158.7360	1232.0311	1213.2598	1163.9824	1089.7666	1009.0558	868.8061	747.0453	695.9696	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.2456	64.5468	64.8509	66.4153	66.7373	68.3952	68.3952	68.7368	67.7223	66.7373	66.0964	65.4677	
alpha	5.2830	5.3031	5.3234	5.4277	5.4492	5.5597	5.5597	5.5825	5.5148	5.4492	5.4064	5.3645	
util living area	0.9386	0.8669	0.7587	0.5895	0.4332	0.2969	0.2129	0.2366	0.3878	0.6597	0.8761	0.9496	(86)
MIT	20.6729	20.7368	20.7858	20.8193	20.8277	20.8325	20.8326	20.8333	20.8306	20.8158	20.7513	20.6656	(87)
Th 2	20.3502	20.3531	20.3559	20.3702	20.3730	20.3874	20.3874	20.3902	20.3816	20.3730	20.3673	20.3616	(88)
util rest of house	0.9294	0.8508	0.7354	0.5619	0.4047	0.2686	0.1833	0.2052	0.3535	0.6264	0.8582	0.9418	(89)
MIT 2	19.9506	20.0304	20.0900	20.1412	20.1526	20.1725	20.1726	20.1763	20.1647	20.1413	20.0630	19.9528	(90)
Living area fraction										fLA = Living area / (4) =		0.3333	(91)
MIT	20.1914	20.2659	20.3219	20.3672	20.3776	20.3925	20.3926	20.3953	20.3867	20.3661	20.2924	20.1904	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1914	20.2659	20.3219	20.3672	20.3776	20.3925	20.3926	20.3953	20.3867	20.3661	20.2924	20.1904	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9269	0.8485	0.7341	0.5618	0.4049	0.2688	0.1836	0.2055	0.3537	0.6260	0.8559	0.9395	(94)
Useful gains	684.0857	765.0941	755.6206	650.9621	498.8201	326.1834	213.6580	223.9481	356.9457	543.8828	639.4088	653.8916	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	953.1351	917.3166	821.2751	665.3125	501.0342	326.3445	213.6721	223.9740	357.7044	563.8844	769.1004	941.1709	(97)
Space heating kWh	200.1728	102.2935	48.8469	10.3322	1.6473	0.0000	0.0000	0.0000	0.0000	14.8811	93.3780	213.7358	(98a)
Space heating requirement - total per year (kWh/year)												685.2877	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	200.1728	102.2935	48.8469	10.3322	1.6473	0.0000	0.0000	0.0000	0.0000	14.8811	93.3780	213.7358	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												685.2877	
Space heating per m2											(98c) / (4) =	7.8769	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 84.1000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	200.1728	102.2935	48.8469	10.3322	1.6473	0.0000	0.0000	0.0000	0.0000	14.8811	93.3780	213.7358	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	238.0176	121.6332	58.0819	12.2857	1.9587	0.0000	0.0000	0.0000	0.0000	17.6946	111.0321	254.1449	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	223.9225	198.0350	210.9046	187.2335	182.5877	165.7551	164.7312	170.7542	171.9986	190.2611	200.3349	221.7660	(64)
Efficiency of water heater												80.5000	(216)
(217)m	84.3425	83.2364	81.9882	80.9084	80.5695	80.5000	80.5000	80.5000	80.5000	81.0676	83.0484	84.5029	(217)
Fuel for water heating, kWh/month	265.4920	237.9187	257.2379	231.4142	226.6213	205.9070	204.6351	212.1170	213.6628	234.6943	241.2265	262.4359	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	31.5859	28.5292	31.5859	30.5670	31.5859	30.5670	31.5859	31.5859	30.5670	31.5859	30.5670	31.5859	(231)
Lighting	30.8382	24.7396	22.2753	16.3198	12.6059	10.2991	11.4995	14.9475	19.4153	25.4740	28.7728	31.6953	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 814.8486 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 80.5000
Water heating fuel used 2793.3627 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)
mechanical ventilation fans (SFP = 1.0360) 285.8987 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 371.8987 (231)
Electricity for lighting (calculated in Appendix L) 248.8823 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4228.9923	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	814.8486	0.2100	171.1182	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2793.3627	0.2100	586.6062	(264)
Space and water heating			757.7244	(265)
Pumps, fans and electric keep-hot	371.8987	0.1387	51.5869	(267)
Energy for lighting	248.8823	0.1443	35.9214	(268)
Total CO2, kg/year			845.2327	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.7200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	814.8486	1.1300	920.7789	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2793.3627	1.1300	3156.4999	(278)
Space and water heating			4077.2788	(279)
Pumps, fans and electric keep-hot	371.8987	1.5128	562.6084	(281)
Energy for lighting	248.8823	1.5338	381.7440	(282)
Total Primary energy kWh/year			5021.6312	(286)
Dwelling Primary energy Rate (DPER)			57.7200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		87.0000	(1b)	x 2.6000	(2b) =	226.2000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		226.2000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1326	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3826	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4878	0.4783	0.4687	0.4209	0.4113	0.3635	0.3635	0.3539	0.3826	0.4113	0.4305	0.4496	(22b)
Effective ac	0.6190	0.6144	0.6098	0.5886	0.5846	0.5661	0.5661	0.5626	0.5732	0.5846	0.5926	0.6011	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			19.4200	1.1450	22.2366			(27)

EXTERNAL	86.2100	21.7600	64.4500	0.1800	11.6010	(29a)
External Roof 1	6.3100		6.3100	0.1100	0.6941	(30)
Total net area of external elements Aum(A, m2)			92.5200			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.8717	(33)
Main dwelling						
Party Wall 1			21.2700	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 168.7229 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	4.8000	0.0500	0.2400
E4 Jamb	27.9200	0.0500	1.3960
E7 Party floor between dwellings (in blocks of flats)	58.6100	0.0700	4.1027
E16 Corner (normal)	10.4000	0.0900	0.9360
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000
E14 Flat roof	7.7100	0.0800	0.6168

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.2165 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 45.0882 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.2057	45.8608	45.5227	43.9347	43.6376	42.2544	42.2544	41.9983	42.7872	43.6376	44.2386	44.8670	(38)
Heat transfer coeff	91.2940	90.9490	90.6109	89.0229	88.7258	87.3427	87.3427	87.0865	87.8754	88.7258	89.3269	89.9552	(39)
Average = Sum(39)m / 12 =												89.0215	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0494	1.0454	1.0415	1.0233	1.0198	1.0039	1.0039	1.0010	1.0101	1.0198	1.0267	1.0340	(40)
HLP (average)												1.0232	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5824 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.5179	66.5033	65.0247	62.1958	60.1080	57.7799	56.4565	57.9239	59.5324	62.0322	64.9219	67.2593	(42a)
Hot water usage for baths	29.1581	28.7251	28.1153	26.9909	26.1490	25.2154	24.7112	25.3167	25.9760	26.9750	28.1225	29.0596	(42b)
Hot water usage for other uses	41.0763	39.5826	38.0889	36.5952	35.1015	33.6079	33.6079	35.1015	36.5952	38.0889	39.5826	41.0763	(42c)
Average daily hot water use (litres/day)												126.6255	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.7524	134.8110	131.2289	125.7819	121.3586	116.6032	114.7755	118.3421	122.1037	127.0961	132.6270	137.3951	(44)
Energy conte	218.1661	191.9690	201.6940	172.1891	163.3720	143.3772	138.8111	146.5323	150.5660	172.4682	188.9515	215.1275	(45)
Energy content (annual)										Total = Sum(45)m =		2103.2239	
Distribution loss (46)m = 0.15 x (45)m	32.7249	28.7954	30.2541	25.8284	24.5058	21.5066	20.8217	21.9798	22.5849	25.8702	28.3427	32.2691	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	269.1250	237.9964	252.6529	221.5042	214.3309	192.6922	189.7700	197.4912	199.8811	223.4271	238.2666	266.0864	(62)
WWHRS	-30.8664	-27.2985	-28.5854	-23.6698	-22.0594	-18.8764	-17.6936	-18.8154	-19.5303	-23.0240	-26.0834	-30.2948	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	238.2586	210.6979	224.0675	197.8344	192.2714	173.8158	172.0763	178.6758	180.3508	200.4030	212.1831	235.7916	(64)
										Total per year (kWh/year) = Sum(64)m =		2416.4264	(64)
12Total per year (kWh/year)												2416	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	85.2799	75.3366	79.8030	69.5817	67.0609	60.0017	58.8944	61.4617	62.3920	70.0854	75.1551	84.2696	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.7455	130.3611	117.7455	121.6704	117.7455	121.6704	117.7455	117.7455	121.6704	117.7455	121.6704	117.7455	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.4490	235.8715	229.7669	216.7711	200.3661	184.9478	174.6474	172.2249	178.3295	191.3253	207.7303	223.1486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	(71)
Water heating gains (Table 5)	114.6236	112.1080	107.2621	96.6412	90.1356	83.3357	79.1592	82.6098	86.6555	94.2008	104.3821	113.2656	(72)
Total internal gains	530.5540	543.0764	519.5104	499.8185	472.9832	451.6897	433.2880	434.3162	448.3913	468.0075	498.5187	518.8956	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.4300	10.6334	0.6300	0.7000	0.7700	11.1465	(74)

East				7.9000		19.6403		0.6300		0.7000		0.7700	47.4183 (76)
South				7.5400		46.7521		0.6300		0.7000		0.7700	107.7318 (78)
West				0.5500		19.6403		0.6300		0.7000		0.7700	3.3013 (80)
Solar gains	169.5979	296.9567	424.3442	550.4632	635.0749	637.5518	611.8050	548.3096	468.3362	333.3913	204.6909	144.0918 (83)	
Total gains	700.1519	840.0332	943.8546	1050.2817	1108.0580	1089.2415	1045.0930	982.6258	916.7275	801.3989	703.2096	662.9874 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6631	44.8325	44.9997	45.8025	45.9559	46.6836	46.6836	46.8209	46.4006	45.9559	45.6466	45.3278	
alpha	3.9775	3.9888	4.0000	4.0535	4.0637	4.1122	4.1122	4.1214	4.0934	4.0637	4.0431	4.0219	
util living area	0.9750	0.9504	0.9072	0.8121	0.6707	0.4966	0.3639	0.4016	0.6145	0.8547	0.9538	0.9792	(86)
MIT	19.5684	19.8667	20.2205	20.6162	20.8595	20.9688	20.9931	20.9898	20.9261	20.5926	20.0237	19.5286	(87)
Th 2	20.0424	20.0457	20.0489	20.0640	20.0668	20.0801	20.0801	20.0825	20.0750	20.0668	20.0611	20.0551	(88)
util rest of house	0.9698	0.9407	0.8896	0.7794	0.6200	0.4309	0.2896	0.3242	0.5462	0.8209	0.9431	0.9749	(89)
MIT 2	18.3882	18.7631	19.2005	19.6790	19.9450	20.0596	20.0771	20.0778	20.0213	19.6666	18.9759	18.3469	(90)
Living area fraction										fLA = Living area / (4) =		0.3333	(91)
MIT	18.7816	19.1310	19.5405	19.9914	20.2499	20.3627	20.3824	20.3818	20.3229	19.9753	19.3252	18.7408	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7816	19.1310	19.5405	19.9914	20.2499	20.3627	20.3824	20.3818	20.3229	19.9753	19.3252	18.7408	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9608	0.9292	0.8786	0.7766	0.6303	0.4515	0.3142	0.3498	0.5652	0.8172	0.9326	0.9668	(94)
Useful gains	672.7133	780.5858	829.2742	815.6575	698.4620	491.7861	328.3797	343.6771	518.1554	654.8869	655.8177	641.0016	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1322.0822	1294.2919	1181.6144	987.3908	758.5936	503.3289	330.3677	346.7585	546.8406	831.8292	1092.0343	1308.0203	(97)
Space heating kWh	483.1305	345.2105	262.1411	123.6480	44.7380	0.0000	0.0000	0.0000	0.0000	131.6451	314.0760	496.2620	(98a)
Space heating requirement - total per year (kWh/year)												2200.8511	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	483.1305	345.2105	262.1411	123.6480	44.7380	0.0000	0.0000	0.0000	0.0000	131.6451	314.0760	496.2620	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2200.8511	
Space heating per m2											(98c) / (4) =	25.2971	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	483.1305	345.2105	262.1411	123.6480	44.7380	0.0000	0.0000	0.0000	0.0000	131.6451	314.0760	496.2620	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	522.8685	373.6044	283.7025	133.8182	48.4177	0.0000	0.0000	0.0000	0.0000	142.4730	339.9091	537.0801	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	238.2586	210.6979	224.0675	197.8344	192.2714	173.8158	172.0763	178.6758	180.3508	200.4030	212.1831	235.7916	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.8628	85.4321	84.7186	83.4032	81.7936	80.3000	80.3000	80.3000	80.3000	83.5026	85.2201	85.9356	(217)
Fuel for water heating, kWh/month	277.4874	246.6261	264.4843	237.2024	235.0691	216.4581	214.2918	222.5103	224.5963	239.9962	248.9825	274.3819	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.4652	19.6269	17.6718	12.9471	10.0007	8.1707	9.1230	11.8584	15.4029	20.2095	22.8266	25.1452	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.3457	-24.6685	-37.9243	-45.6973	-51.9963	-49.5274	-48.9147	-44.8091	-38.0827	-29.5029	-18.5342	-13.9483	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.8852	-10.5816	-21.6184	-33.3571	-44.9992	-45.5540	-45.0292	-37.7217	-27.1178	-15.4279	-6.6140	-3.8415	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2381.8735	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2902.0864	(219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	197.4482	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-716.6988	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4850.7092	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2381.8735	0.2100	500.1934	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2902.0864	0.2100	609.4381	(264)
Space and water heating			1109.6316	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	197.4482	0.1443	28.4979	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-419.9513	0.1332	-55.9341	
PV Unit electricity exported	-296.7476	0.1251	-37.1258	
Total			-93.0599	(269)
Total CO2, kg/year			1056.9988	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2381.8735	1.1300	2691.5170	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2902.0864	1.1300	3279.3576	(278)
Space and water heating			5970.8746	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	197.4482	1.5338	302.8526	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-419.9513	1.4922	-626.6407	
PV Unit electricity exported	-296.7476	0.4592	-136.2658	
Total			-762.9065	(283)
Total Primary energy kWh/year			5640.9215	(286)
Target Primary Energy Rate (TPER)			64.8400	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 5	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	85 B	**DER**	11.08	**TER**	13.59
Environmental	92 A	**% DER < TER**			18.47
CO_2 Emissions (t/year)	0.63	**DFEE**	22.37	**TFEE**	29.08
Compliance Check	See BREL	**% DFEE < TFEE**			23.09
% DPER < TPER	10.35	**DPER**	65.39	**TPER**	72.94

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			15.6000	0.7752	12.0930			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1400	5.3466	70.0000	2673.3000	(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.3116			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			61.0000			30.0000	1830.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12845.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		210.5820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100

E3 Sill	4.0300	0.0400	0.1612	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.7848 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.0964 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.9818	14.7855	14.5892	13.6079	13.4116	12.4303	12.4303	12.2340	12.8228	13.4116	13.8041	14.1967	(38)
Heat transfer coeff	40.0782	39.8819	39.6856	38.7043	38.5080	37.5267	37.5267	37.3304	37.9192	38.5080	38.9006	39.2931	(39)
Average = Sum(39)m / 12 =												38.6552	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6570	0.6538	0.6506	0.6345	0.6313	0.6152	0.6152	0.6120	0.6216	0.6313	0.6377	0.6441	(40)
HLP (average)												0.6337	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)
Hot water usage for mixer showers

65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 115.2889 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.3976	122.7662	119.5355	114.5599	110.5421	106.2135	104.5036	107.7199	111.1185	115.6688	120.7229	125.0633	(44)
Energy conte	198.5991	174.8175	183.7216	156.8267	148.8109	130.6019	126.3880	133.3797	137.0202	156.9614	171.9919	195.8189	(45)
Energy content (annual)										Total = Sum(45)m =		1914.9379	
Distribution loss (46)m = 0.15 x (45)m	29.7899	26.2226	27.5582	23.5240	22.3216	19.5903	18.9582	20.0070	20.5530	23.5442	25.7988	29.3728	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	249.5580	220.8449	234.6805	206.1418	199.7698	179.9170	177.3469	184.3386	186.3353	207.9203	221.3070	246.7778	(62)
WWHRS	-50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	199.3177	176.4120	188.1529	167.6151	163.8643	149.1924	148.5475	153.7133	154.5465	170.4448	178.8518	197.4679	(64)
									Total per year (kWh/year) = Sum(64)m =			2048.1262	(64)
12Total per year (kWh/year)												2048	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month	78.7739	69.6337	73.8272	64.4737	62.2193	55.7539	54.7637	57.0885	57.8880	64.9294	69.5161	77.8495	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	105.8789	103.6215	99.2300	89.5467	83.6281	77.4360	73.6072	76.7318	80.4000	87.2707	96.5501	104.6364	(72)
Total internal gains	425.9816	435.0265	416.5652	400.0640	378.8655	361.0346	346.5142	347.8181	359.0243	375.7129	400.2722	416.9973	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	538.2841	635.7242	712.0628	794.5439	841.7540	828.5391	794.0196	743.9238	689.1927	603.5552	536.5966	511.8787	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	89.0309	89.4690	89.9115	92.1912	92.6610	95.0842	95.0842	95.5841	94.0999	92.6610	91.7260	90.8097	
alpha	6.9354	6.9646	6.9941	7.1461	7.1774	7.3389	7.3389	7.3723	7.2733	7.1774	7.1151	7.0540	
util living area	0.9475	0.8788	0.7654	0.5838	0.4249	0.2898	0.2079	0.2308	0.3794	0.6514	0.8801	0.9571	(86)
MIT	20.7764	20.8194	20.8496	20.8669	20.8698	20.8728	20.8728	20.8734	20.8716	20.8659	20.8304	20.7723	(87)
Th 2	20.3790	20.3818	20.3847	20.3991	20.4019	20.4163	20.4163	20.4192	20.4106	20.4019	20.3962	20.3904	(88)
util rest of house	0.9378	0.8613	0.7404	0.5562	0.3978	0.2634	0.1804	0.2017	0.3471	0.6171	0.8601	0.9490	(89)
MIT 2	20.1062	20.1598	20.1964	20.2293	20.2349	20.2532	20.2532	20.2568	20.2459	20.2315	20.1878	20.1125	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	20.3809	20.4301	20.4641	20.4906	20.4951	20.5071	20.5071	20.5095	20.5023	20.4915	20.4511	20.3829	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3809	20.4301	20.4641	20.4906	20.4951	20.5071	20.5071	20.5095	20.5023	20.4915	20.4511	20.3829	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9378	0.8628	0.7437	0.5604	0.4020	0.2675	0.1847	0.2062	0.3521	0.6223	0.8620	0.9489	(94)
Useful gains	504.8266	548.4770	529.5772	445.2883	338.3881	221.6650	146.6216	153.4087	242.6925	375.6166	462.5459	485.7056	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	644.4925	619.3703	554.1754	448.6062	338.6822	221.6752	146.6221	153.4098	242.7720	380.9026	519.3672	635.8760	(97)
Space heating kWh	103.9114	47.6403	18.3010	2.3889	0.2189	0.0000	0.0000	0.0000	0.0000	3.9328	40.9113	111.7268	(98a)
Space heating requirement - total per year (kWh/year)												329.0313	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	103.9114	47.6403	18.3010	2.3889	0.2189	0.0000	0.0000	0.0000	0.0000	3.9328	40.9113	111.7268	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												329.0313	
Space heating per m2											(98c) / (4) =	5.3940	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												84.1000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	103.9114	47.6403	18.3010	2.3889	0.2189	0.0000	0.0000	0.0000	0.0000	3.9328	40.9113	111.7268	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	123.5569	56.6472	21.7610	2.8405	0.2602	0.0000	0.0000	0.0000	0.0000	4.6764	48.6460	132.8499	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	199.3177	176.4120	188.1529	167.6151	163.8643	149.1924	148.5475	153.7133	154.5465	170.4448	178.8518	197.4679	(64)
Efficiency of water heater												80.5000	(216)
(217)m	83.2537	82.1867	81.1947	80.6093	80.5104	80.5000	80.5000	80.5000	80.5000	80.6756	81.9729	83.4091	(217)
Fuel for water heating, kWh/month	239.4100	214.6477	231.7305	207.9351	203.5319	185.3322	184.5311	190.9482	191.9832	211.2718	218.1839	236.7462	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	24.3293	21.9748	24.3293	23.5445	24.3293	23.5445	24.3293	24.3293	23.5445	24.3293	23.5445	24.3293	(231)
Lighting	21.8087	17.4957	15.7530	11.5413	8.9148	7.2835	8.1324	10.5708	13.7304	18.0151	20.3480	22.4148	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												391.2382	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.5000	
Water heating fuel used												2516.2519	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)													
mechanical ventilation fans (SFP = 1.0360)												200.4577	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												286.4577	(231)
Electricity for lighting (calculated in Appendix L)												176.0085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3369.9564	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	391.2382	0.2100	82.1600	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2516.2519	0.2100	528.4129	(264)
Space and water heating			610.5729	(265)
Pumps, fans and electric keep-hot	286.4577	0.1387	39.7352	(267)
Energy for lighting	176.0085	0.1443	25.4035	(268)
Total CO2, kg/year			675.7116	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.0800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	391.2382	1.1300	442.0992	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2516.2519	1.1300	2843.3647	(278)
Space and water heating			3285.4639	(279)
Pumps, fans and electric keep-hot	286.4577	1.5128	433.3532	(281)
Energy for lighting	176.0085	1.5338	269.9678	(282)
Total Primary energy kWh/year			3988.7848	(286)
Dwelling Primary energy Rate (DPER)			65.3900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b) x	2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3761 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			12.9100	1.1450	14.7824			(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584			(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)

Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 24.4808 (33)

Main dwelling

Party Wall 1	32.7900	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 220.5820 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100
E3 Sill	4.0300	0.0500	0.2015
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680
E18 Party wall between dwellings	10.4000	0.0600	0.6240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8251 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.3059 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	62.4925	62.2589	62.0298	60.9540	60.7527	59.8157	59.8157	59.6422	60.1766	60.7527	61.1599	61.5856	(39)
Average = Sum(39)m / 12 =												60.9530	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0206	1.0169	0.9992	0.9959	0.9806	0.9806	0.9777	0.9865	0.9959	1.0026	1.0096	(40)
HLP (average)												0.9992	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)
Hot water usage for baths	25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)
Hot water usage for other uses	35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)
Average daily hot water use (litres/day)												108.6142	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.1691	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	238.0923	210.6907	223.9644	197.0124	191.0935	172.2990	169.2359	176.6483	178.4640	198.8945	211.3894	235.4858	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
									Total per year (kWh/year) = Sum(64)m =			2157.2560	(64)
12Total per year (kWh/year)												2157	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month	74.9616	66.2574	70.2641	61.4381	59.3345	53.2209	52.1320	54.5314	55.2708	61.9283	66.2185	74.0949	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	100.7548	98.5973	94.4409	85.3307	79.7506	73.9179	70.0699	73.2949	76.7650	83.2370	91.9701	99.5899	(72)
Total internal gains	421.0597	430.2262	411.9783	396.0569	375.1902	357.7256	343.1791	344.5834	355.5982	371.8814	395.9012	412.1530	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1200	10.6334	0.6300	0.7000	0.7700	6.8894	(74)
East	7.0400	19.6403	0.6300	0.7000	0.7700	42.2563	(76)
South	3.7500	46.7521	0.6300	0.7000	0.7700	53.5801	(78)

Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	523.7855	613.8049	682.2621	756.8684	798.5671	785.3233	752.4852	706.8799	657.5911	580.2867	520.5996	498.9440	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8094	60.0339	60.2555	61.3190	61.5222	62.4859	62.4859	62.6677	62.1111	61.5222	61.1126	60.6901	
alpha	4.9873	5.0023	5.0170	5.0879	5.1015	5.1657	5.1657	5.1778	5.1407	5.1015	5.0742	5.0460	
util living area	0.9837	0.9648	0.9255	0.8247	0.6672	0.4813	0.3488	0.3863	0.6081	0.8695	0.9661	0.9868	(86)
MIT	19.9498	20.1841	20.4665	20.7736	20.9356	20.9903	20.9985	20.9975	20.9693	20.7456	20.3068	19.9188	(87)
Th 2	20.0630	20.0662	20.0693	20.0840	20.0867	20.0995	20.0995	20.1019	20.0946	20.0867	20.0811	20.0753	(88)
util rest of house	0.9795	0.9561	0.9079	0.7892	0.6131	0.4162	0.2779	0.3118	0.5370	0.8332	0.9562	0.9833	(89)
MIT 2	18.8590	19.1540	19.5015	19.8675	20.0356	20.0940	20.0990	20.1010	20.0750	19.8486	19.3224	18.8292	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	19.3061	19.5761	19.8970	20.2389	20.4045	20.4613	20.4677	20.4684	20.4415	20.2162	19.7258	19.2757	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3061	19.5761	19.8970	20.2389	20.4045	20.4613	20.4677	20.4684	20.4415	20.2162	19.7258	19.2757	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9506	0.9042	0.7956	0.6325	0.4426	0.3070	0.3424	0.5649	0.8389	0.9515	0.9794	(94)
Useful gains	510.7226	583.4844	616.9180	602.1517	505.0854	347.5679	230.9843	242.0195	371.4902	486.8075	495.3536	488.6494	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	937.7669	913.7201	831.0143	691.1484	528.8210	350.6002	231.3465	242.6483	381.6118	584.2091	772.1955	928.4484	(97)
Space heating kWh	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98a)
Space heating requirement - total per year (kWh/year)												1379.6673	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1379.6673	
Space heating per m2											(98c) / (4) =	22.6175	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	317.7209	221.9184	159.2876	64.0776	17.6593	0.0000	0.0000	0.0000	0.0000	72.4668	199.3262	327.2104	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	343.8538	240.1715	172.3892	69.3481	19.1118	0.0000	0.0000	0.0000	0.0000	78.4273	215.7210	354.1238	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.2500	84.7461	83.9041	82.4218	81.0292	80.3000	80.3000	80.3000	80.3000	82.6014	84.4955	85.3327	(217)
Fuel for water heating, kWh/month	248.2289	220.9826	237.7048	214.3952	212.4801	194.4045	191.8535	199.8860	201.3836	216.8783	223.6985	245.5085	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1493.1464	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2607.4045	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)

Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3832.7739	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1493.1464	0.2100	313.5607	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2607.4045	0.2100	547.5549	(264)
Space and water heating			861.1157	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			829.2382	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1493.1464	1.1300	1687.2554	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2607.4045	1.1300	2946.3671	(278)
Space and water heating			4633.6225	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4449.3847	(286)
Target Primary Energy Rate (TPER)			72.9400	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 6	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	12.81	**TER**	15.50
Environmental	91 B	**% DER < TER**			17.35
CO_2 Emissions (t/year)	0.59	**DFEE**	25.97	**TFEE**	32.55
Compliance Check	See BREL	**% DFEE < TFEE**			20.22
% DPER < TPER	10.17	**DPER**	74.93	**TPER**	83.41

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	130.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			16.3200	0.7752	12.6512			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1400	4.4534	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			58.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.0452			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9072.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.4460 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150	
E3 Sill	6.6300	0.0400	0.2652	
E4 Jamb	22.8600	0.0500	1.1430	
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8630 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.9082 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.2801	12.1193	11.9584	11.1540	10.9931	10.1887	10.1887	10.0279	10.5105	10.9931	11.3149	11.6366	(38)
Heat transfer coeff	38.1883	38.0274	37.8665	37.0622	36.9013	36.0969	36.0969	35.9360	36.4187	36.9013	37.2230	37.5448	(39)

Average = Sum(39)m / 12 = 37.0219

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7638	0.7605	0.7573	0.7412	0.7380	0.7219	0.7219	0.7187	0.7284	0.7380	0.7445	0.7509	(40)
HLP (average)												0.7404	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 104.6166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7893	111.4018	108.4704	103.9553	100.3096	96.3818	94.8299	97.7482	100.8321	104.9611	109.5474	113.4859	(44)
Energy conte	180.2144	158.6347	166.7150	142.3097	135.0360	118.5126	114.6885	121.0327	124.3360	142.4312	156.0703	177.6915	(45)

Energy content (annual) Total = Sum(45)m = 1737.6727

Distribution loss (46)m = 0.15 x (45)m	27.0322	23.7952	25.0072	21.3465	20.2554	17.7769	17.2033	18.1549	18.6504	21.3647	23.4105	26.6537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	47.5307	48.3243	49.8114	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	231.1733	204.6621	217.6739	191.6247	185.9949	166.0434	163.0128	170.8441	173.6511	193.3901	205.3854	228.6504	(62)
WWHRS	-45.5909	-40.3210	-42.2218	-34.9613	-32.5827	-27.8812	-26.1342	-27.7911	-28.8470	-34.0074	-38.5263	-44.7466	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	185.5824	164.3412	175.4521	156.6634	153.4122	138.1621	136.8786	143.0530	144.8041	159.3826	166.8591	183.9038	(64)

Total per year (kWh/year) = Sum(64)m = 1908.4946 (64)

12Total per year (kWh/year) 1908 (64)

Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	72.6610	64.2529	68.1724	59.6467	57.6392	51.2881	50.2150	52.6962	53.6705	60.0981	64.2222	71.8222	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	97.6627	95.6144	91.6296	82.8427	77.4720	71.2335	67.4933	70.8283	74.5424	80.7770	89.1974	96.5352	(72)
Total internal gains	370.5107	377.9470	362.1555	347.6476	329.4551	312.9678	300.2558	302.0630	312.1025	327.0581	348.3004	362.8869	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	503.7441	614.0839	704.0477	793.6089	842.7224	826.8006	793.9961	746.1086	690.7346	593.6507	509.6931	475.6621	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	65.9910	66.2702	66.5517	67.9961	68.2926	69.8144	69.8144	70.1269	69.1976	68.2926	67.7022	67.1221	
alpha	5.3994	5.4180	5.4368	5.5331	5.5528	5.6543	5.6543	5.6751	5.6132	5.5528	5.5135	5.4748	
util living area	0.9245	0.8429	0.7242	0.5544	0.4056	0.2793	0.2000	0.2215	0.3630	0.6250	0.8528	0.9375	(86)
MIT	20.6984	20.7571	20.7994	20.8254	20.8314	20.8353	20.8354	20.8360	20.8338	20.8228	20.7687	20.6907	(87)
Th 2	20.2848	20.2877	20.2905	20.3045	20.3074	20.3215	20.3215	20.3243	20.3158	20.3074	20.3017	20.2961	(88)
util rest of house	0.9124	0.8231	0.6975	0.5248	0.3759	0.2497	0.1692	0.1890	0.3273	0.5884	0.8306	0.9271	(89)
MIT 2	19.9183	19.9904	20.0408	20.0828	20.0915	20.1102	20.1103	20.1139	20.1028	20.0837	20.0192	19.9199	(90)
Living area fraction									fLA = Living area / (4) =			0.5200	(91)
MIT	20.3239	20.3891	20.4353	20.4690	20.4762	20.4873	20.4873	20.4894	20.4829	20.4680	20.4089	20.3207	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3239	20.3891	20.4353	20.4690	20.4762	20.4873	20.4873	20.4894	20.4829	20.4680	20.4089	20.3207	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9132	0.8261	0.7031	0.5319	0.3831	0.2569	0.1767	0.1969	0.3360	0.5970	0.8342	0.9275	(94)
Useful gains	459.9954	507.2742	495.0116	422.1158	322.8673	212.4393	140.3144	146.9440	232.1158	354.4164	425.1761	441.1861	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	611.9270	589.0099	527.6808	428.7705	323.8542	212.5122	140.3208	146.9557	232.4575	364.1420	495.3994	605.2487	(97)
Space heating kWh	113.0371	54.9264	24.3058	4.7914	0.7342	0.0000	0.0000	0.0000	0.0000	7.2359	50.5607	122.0626	(98a)
Space heating requirement - total per year (kWh/year)												377.6542	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	113.0371	54.9264	24.3058	4.7914	0.7342	0.0000	0.0000	0.0000	0.0000	7.2359	50.5607	122.0626	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												377.6542	
Space heating per m2										(98c) / (4) =		7.5531	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												84.1000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	113.0371	54.9264	24.3058	4.7914	0.7342	0.0000	0.0000	0.0000	0.0000	7.2359	50.5607	122.0626	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	134.4080	65.3109	28.9011	5.6972	0.8730	0.0000	0.0000	0.0000	0.0000	8.6039	60.1198	145.1398	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	185.5824	164.3412	175.4521	156.6634	153.4122	138.1621	136.8786	143.0530	144.8041	159.3826	166.8591	183.9038	(64)
Efficiency of water heater												80.5000	(216)
(217)m	83.5527	82.4946	81.4567	80.7312	80.5370	80.5000	80.5000	80.5000	80.5000	80.8388	82.3484	83.7239	(217)
Fuel for water heating, kWh/month	222.1142	199.2145	215.3932	194.0555	190.4865	171.6300	170.0355	177.7056	179.8808	197.1610	202.6258	219.6551	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	21.2592	19.2018	21.2592	20.5734	21.2592	20.5734	21.2592	21.2592	20.5734	21.2592	20.5734	21.2592	(231)
Lighting	17.4563	14.0041	12.6091	9.2380	7.1357	5.8299	6.5094	8.4612	10.9902	14.4198	16.2871	17.9414	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												449.0537	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.5000	
Water heating fuel used												2339.9577	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)													
mechanical ventilation fans (SFP = 1.0360)												164.3096	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												250.3096	(231)
Electricity for lighting (calculated in Appendix L)												140.8820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3180.2030	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	449.0537	0.2100	94.3013	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2339.9577	0.2100	491.3911	(264)
Space and water heating			585.6924	(265)
Pumps, fans and electric keep-hot	250.3096	0.1387	34.7210	(267)
Energy for lighting	140.8820	0.1443	20.3336	(268)
Total CO2, kg/year			640.7470	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.8100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	449.0537	1.1300	507.4307	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2339.9577	1.1300	2644.1522	(278)
Space and water heating			3151.5829	(279)
Pumps, fans and electric keep-hot	250.3096	1.5128	378.6684	(281)
Energy for lighting	140.8820	1.5338	216.0894	(282)
Total Primary energy kWh/year			3746.3407	(286)
Dwelling Primary energy Rate (DPER)			74.9300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b) x	2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		130.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			10.1500	1.1450	11.6221			(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)

Total net area of external elements Aum(A, m2) 58.6900 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 22.2781 (33)
Main dwelling
Party Wall 1 15.3900 0.0000 0.0000 (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 191.4460 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9293 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 28.2074 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	55.3444	55.1236	54.9071	53.8904	53.7002	52.8147	52.8147	52.6507	53.1558	53.7002	54.0850	54.4873	(39)
Average = Sum(39)m / 12 =												53.8895	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1069	1.1025	1.0981	1.0778	1.0740	1.0563	1.0563	1.0530	1.0631	1.0740	1.0817	1.0897	(40)
HLP (average)												1.0778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)
Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
									Total per year (kWh/year) = Sum(64)m =			1992.9475	(64)
12Total per year (kWh/year)												1993	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557	(72)
Total internal gains	366.2732	373.8444	358.2220	343.8889	325.4004	309.2388	296.7585	298.3915	308.3807	323.6261	344.5705	358.7198	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7800	19.6403	0.6300	0.7000	0.7700	34.6934	(76)
South	3.7000	46.7521	0.6300	0.7000	0.7700	52.8657	(78)
West	0.6700	19.6403	0.6300	0.7000	0.7700	4.0216	(80)

Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	457.8540	536.1596	593.2344	650.4414	678.2217	662.4500	636.1575	603.6283	568.6491	506.8768	455.5074	436.2380	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0441	48.2366	48.4267	49.3404	49.5151	50.3453	50.3453	50.5021	50.0223	49.5151	49.1628	48.7999	
alpha	4.2029	4.2158	4.2284	4.2894	4.3010	4.3564	4.3564	4.3668	4.3348	4.3010	4.2775	4.2533	
util living area	0.9729	0.9490	0.9064	0.8120	0.6715	0.4965	0.3624	0.3967	0.6071	0.8485	0.9502	0.9772	(86)
MIT	19.7280	19.9930	20.3121	20.6685	20.8823	20.9756	20.9950	20.9927	20.9422	20.6563	20.1478	19.6955	(87)
Th 2	19.9952	19.9988	20.0024	20.0190	20.0221	20.0367	20.0367	20.0394	20.0311	20.0221	20.0158	20.0092	(88)
util rest of house	0.9668	0.9380	0.8869	0.7763	0.6170	0.4269	0.2845	0.3160	0.5344	0.8106	0.9376	0.9719	(89)
MIT 2	18.5429	18.8748	19.2671	19.6954	19.9244	20.0218	20.0348	20.0364	19.9919	19.6956	19.0851	18.5122	(90)
Living area fraction									fLA = Living area / (4) =			0.5200	(91)
MIT	19.1592	19.4563	19.8105	20.2014	20.4225	20.5178	20.5341	20.5337	20.4861	20.1951	19.6377	19.1275	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1592	19.4563	19.8105	20.2014	20.4225	20.5178	20.5341	20.5337	20.4861	20.1951	19.6377	19.1275	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9603	0.9309	0.8826	0.7834	0.6400	0.4622	0.3249	0.3579	0.5695	0.8180	0.9318	0.9659	(94)
Useful gains	439.6766	499.1278	523.6068	509.5275	434.0850	306.1732	206.7081	216.0161	323.8422	414.6006	424.4402	421.3812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	822.3718	802.3943	730.8413	609.0395	468.3983	312.5461	207.7794	217.6406	339.4556	515.2610	678.1017	813.3609	(97)
Space heating kWh	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98a)
Space heating requirement - total per year (kWh/year)												1289.0410	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1289.0410	
Space heating per m2											(98c) / (4) =	25.7808	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	284.7252	203.7951	154.1825	71.6486	25.5291	0.0000	0.0000	0.0000	0.0000	74.8914	182.6363	291.6329	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	308.1442	220.5575	166.8642	77.5418	27.6288	0.0000	0.0000	0.0000	0.0000	81.0512	197.6583	315.6200	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.1725	84.7186	83.9856	82.7347	81.3945	80.3000	80.3000	80.3000	80.3000	82.7822	84.4599	85.2437	(217)
Fuel for water heating, kWh/month	230.9921	205.6197	221.1071	198.0806	194.2729	176.4186	174.0932	182.2506	185.3789	201.4076	208.4800	228.5465	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1395.0661	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2406.6478	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)

Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3601.0410	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1395.0661	0.2100	292.9639	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2406.6478	0.2100	505.3960	(264)
Space and water heating			798.3599	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			774.8498	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.5000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1395.0661	1.1300	1576.4247	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2406.6478	1.1300	2719.5120	(278)
Space and water heating			4295.9367	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4170.7442	(286)
Target Primary Energy Rate (TPER)			83.4100	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 7	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	14.16	**TER**	17.71
Environmental	91 B	**% DER < TER**			20.05
CO_2 Emissions (t/year)	0.52	**DFEE**	25.86	**TFEE**	34.69
Compliance Check	See BREL	**% DFEE < TFEE**			25.45
% DPER < TPER	13.82	**DPER**	82.49	**TPER**	95.72

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000 (1b)	x	2.6000 (2b)	=	101.4000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	101.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			7.6400	0.7752	5.9225			(27)
EXTERNAL	36.0400	9.9800	26.0600	0.1400	3.6484	70.0000	1824.2000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		12.5115			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			39.0000			40.0000	1560.0000	(32d)
Party Ceiling 1			39.0000			30.0000	1170.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8958.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		229.6974 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900	
E3 Sill	4.8000	0.0400	0.1920	
E4 Jamb	13.3400	0.0500	0.6670	
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	2.6000	0.0600	0.1560	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1558 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 16.6673 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.5785	9.4530	9.3275	8.7001	8.5746	7.9472	7.9472	7.8217	8.1982	8.5746	8.8256	9.0766	(38)
Heat transfer coeff	26.2458	26.1203	25.9948	25.3674	25.2419	24.6145	24.6145	24.4890	24.8655	25.2419	25.4929	25.7438	(39)
Average = Sum(39)m / 12 =												25.3360	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6730	0.6698	0.6665	0.6504	0.6472	0.6311	0.6311	0.6279	0.6376	0.6472	0.6537	0.6601	(40)
HLP (average)												0.6496	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3800 (42)
Hot water usage for mixer showers

53.2775	52.4768	51.3101	49.0778	47.4304	45.5933	44.5491	45.7069	46.9762	48.9487	51.2290	53.0734	(42a)

Hot water usage for baths

20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)

Hot water usage for other uses

28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)

Average daily hot water use (litres/day) 94.2642 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.5289	100.3780	97.7369	93.6686	90.3837	86.8447	85.4461	88.0754	90.8539	94.5742	98.7067	102.2555	(44)
Energy conte	162.3807	142.9370	150.2179	128.2276	121.6738	106.7856	103.3396	109.0557	112.0319	128.3364	140.6259	160.1074	(45)
Energy content (annual)										Total = Sum(45)m =		1565.7195	
Distribution loss (46)m = 0.15 x (45)m	24.3571	21.4405	22.5327	19.2341	18.2511	16.0178	15.5009	16.3584	16.8048	19.2505	21.0939	24.0161	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	49.8056	46.1927	46.0585	42.8275	43.5424	44.8823	44.8046	48.1940	48.6773	50.9589	(61)
Total heat required for water heating calculated for each month	213.3396	188.9643	200.0236	174.4204	167.7324	149.6131	146.8820	153.9380	156.8365	176.5303	189.3032	211.0663	(62)
WWHRS	-41.0809	-36.3323	-38.0450	-31.5028	-29.3595	-25.1231	-23.5489	-25.0419	-25.9933	-30.6433	-34.7151	-40.3201	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	172.2587	152.6321	161.9786	142.9176	138.3729	124.4900	123.3331	128.8961	130.8432	145.8871	154.5880	170.7462	(64)
										Total per year (kWh/year) = Sum(64)m =		1746.9436	(64)
12Total per year (kWh/year)												1747	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	66.7313	59.0334	62.3989	54.1839	51.9712	46.2131	45.2460	47.4816	48.4518	54.7203	58.9274	65.9754	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.8268	68.4511	61.8268	63.8877	61.8268	63.8877	61.8268	61.8268	63.8877	61.8268	63.8877	61.8268	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	89.6926	87.8473	83.8695	75.2554	69.8537	64.1849	60.8146	63.8193	67.2941	73.5488	81.8436	88.6766	(72)
Total internal gains	317.2466	323.2607	309.5461	296.3668	280.5400	266.0708	255.3878	257.1575	265.8056	279.6255	298.3455	310.9788	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains	41.4903	81.1639	133.6653	194.9429	238.9099	244.5668	232.8375	200.0040	155.4583	96.3078	51.7336	34.1196	(83)
Total gains	358.7369	404.4246	443.2114	491.3097	519.4499	510.6375	488.2253	457.1615	421.2639	375.9333	350.0790	345.0984	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	94.8110	95.2665	95.7264	98.0940	98.5816	101.0944	101.0944	101.6124	100.0741	98.5816	97.6111	96.6596	
alpha	7.3207	7.3511	7.3818	7.5396	7.5721	7.7396	7.7396	7.7742	7.6716	7.5721	7.5074	7.4440	
util living area	0.9484	0.8967	0.7987	0.6179	0.4513	0.3085	0.2218	0.2464	0.4070	0.6837	0.8877	0.9558	(86)
MIT	20.7931	20.8262	20.8550	20.8734	20.8765	20.8794	20.8794	20.8799	20.8782	20.8723	20.8403	20.7913	(87)
Th 2	20.3648	20.3676	20.3705	20.3848	20.3877	20.4021	20.4021	20.4049	20.3963	20.3877	20.3819	20.3762	(88)
util rest of house	0.9382	0.8798	0.7733	0.5882	0.4218	0.2797	0.1917	0.2145	0.3715	0.6475	0.8672	0.9468	(89)
MIT 2	20.1128	20.1546	20.1897	20.2235	20.2293	20.2473	20.2473	20.2508	20.2401	20.2257	20.1859	20.1219	(90)
Living area fraction									fLA = Living area / (4) =			0.7436	(91)
MIT	20.6187	20.6540	20.6844	20.7068	20.7105	20.7173	20.7173	20.7186	20.7146	20.7065	20.6725	20.6197	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6187	20.6540	20.6844	20.7068	20.7105	20.7173	20.7173	20.7186	20.7146	20.7065	20.6725	20.6197	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9425	0.8877	0.7862	0.6038	0.4374	0.2949	0.2076	0.2313	0.3903	0.6666	0.8772	0.9505	(94)
Useful gains	338.0932	359.0262	348.4531	296.6654	227.1969	150.5656	101.3447	105.7574	164.4015	250.5921	307.0966	328.0216	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	428.2968	411.4986	368.7207	299.5078	227.4430	150.5739	101.3451	105.7583	164.4752	255.1071	346.0014	422.7052	(97)
Space heating kWh	67.1115	35.2614	15.0791	2.0465	0.1831	0.0000	0.0000	0.0000	0.0000	3.3591	28.0115	70.4446	(98a)
Space heating requirement - total per year (kWh/year)												221.4968	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	67.1115	35.2614	15.0791	2.0465	0.1831	0.0000	0.0000	0.0000	0.0000	3.3591	28.0115	70.4446	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												221.4968	
Space heating per m2											(98c) / (4) =	5.6794	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 84.1000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	67.1115	35.2614	15.0791	2.0465	0.1831	0.0000	0.0000	0.0000	0.0000	3.3591	28.0115	70.4446	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	80.5000	(210)
Space heating fuel (main heating system)	79.7996	41.9280	17.9300	2.4334	0.2178	0.0000	0.0000	0.0000	0.0000	3.9942	33.3074	83.7628	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	172.2587	152.6321	161.9786	142.9176	138.3729	124.4900	123.3331	128.8961	130.8432	145.8871	154.5880	170.7462	(64)
Efficiency of water heater												80.5000	(216)
(217)m	82.7390	81.9851	81.1672	80.6098	80.5103	80.5000	80.5000	80.5000	80.5000	80.6753	81.7099	82.8352	(217)
Fuel for water heating, kWh/month	208.1953	186.1706	199.5616	177.2954	171.8699	154.6460	153.2089	160.1194	162.5381	180.8325	189.1914	206.1276	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.1891	16.4288	18.1891	17.6023	18.1891	17.6023	18.1891	18.1891	17.6023	18.1891	17.6023	18.1891	(231)
Lighting	13.4326	10.7761	9.7027	7.1086	5.4909	4.4861	5.0090	6.5109	8.4570	11.0960	12.5329	13.8059	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 263.3732 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 80.5000
Water heating fuel used 2149.7566 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)
mechanical ventilation fans (SFP = 1.0360) 128.1615 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 214.1615 (231)
Electricity for lighting (calculated in Appendix L) 108.4087 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)
Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2735.6999	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	263.3732	0.2100	55.3084	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2149.7566	0.2100	451.4489	(264)
Space and water heating			506.7572	(265)
Pumps, fans and electric keep-hot	214.1615	0.1387	29.7068	(267)
Energy for lighting	108.4087	0.1443	15.6467	(268)
Total CO2, kg/year			552.1108	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.1600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	263.3732	1.1300	297.6117	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2149.7566	1.1300	2429.2250	(278)
Space and water heating			2726.8366	(279)
Pumps, fans and electric keep-hot	214.1615	1.5128	323.9835	(281)
Energy for lighting	108.4087	1.5338	166.2809	(282)
Total Primary energy kWh/year			3217.1010	(286)
Dwelling Primary energy Rate (DPER)			82.4900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000	(1b) x	2.6000	(2b) =	101.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	101.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1972	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4472	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4472	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5702	0.5590	0.5479	0.4920	0.4808	0.4249	0.4249	0.4137	0.4472	0.4808	0.5031	0.5255	(22b)
Effective ac	0.6626	0.6563	0.6501	0.6210	0.6156	0.5903	0.5903	0.5856	0.6000	0.6156	0.6266	0.6381	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			7.4100	1.1450	8.4847			(27)
EXTERNAL	36.0400	9.7500	26.2900	0.1800	4.7322			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)

Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 17.0365 (33)
Main dwelling
Party Wall 1 21.2700 0.0000 0.0000 (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 239.6974 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900	
E3 Sill	4.8000	0.0500	0.2400	
E4 Jamb	13.3400	0.0500	0.6670	
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	2.6000	0.0600	0.1560	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.2038 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 21.2403 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.1713	21.9600	21.7530	20.7804	20.5984	19.7513	19.7513	19.5944	20.0776	20.5984	20.9665	21.3514	(38)
Heat transfer coeff	43.4116	43.2004	42.9933	42.0207	41.8387	40.9916	40.9916	40.8347	41.3179	41.8387	42.2068	42.5917	(39)
Average = Sum(39)m / 12 =												42.0198	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1131	1.1077	1.1024	1.0775	1.0728	1.0511	1.0511	1.0470	1.0594	1.0728	1.0822	1.0921	(40)
HLP (average)												1.0774	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3800 (42)
Hot water usage for mixer showers

47.3578	46.6461	45.6090	43.6247	42.1604	40.5274	39.5992	40.6284	41.7566	43.5100	45.5369	47.1763	(42a)

Hot water usage for baths

20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)

Hot water usage for other uses

28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)

Average daily hot water use (litres/day) 88.8064 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.6092	94.5473	92.0358	88.2155	85.1137	81.7787	80.4962	82.9968	85.6343	89.1355	93.0146	96.3584	(44)
Energy conte	153.0053	134.6340	141.4555	120.7626	114.5793	100.5565	97.3532	102.7674	105.5956	120.9560	132.5164	150.8740	(45)
Energy content (annual)										Total = Sum(45)m =		1475.0560	
Distribution loss (46)m = 0.15 x (45)m	22.9508	20.1951	21.2183	18.1144	17.1869	15.0835	14.6030	15.4151	15.8393	18.1434	19.8775	22.6311	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	49.2310	43.5176	46.9004	43.5035	43.3730	40.3292	41.0200	42.2943	42.2306	45.4225	45.8702	49.1032	(61)
Total heat required for water heating calculated for each month	202.2362	178.1517	188.3559	164.2662	157.9523	140.8857	138.3732	145.0617	147.8262	166.3785	178.3866	199.9772	(62)
WWHRS	-21.6500	-19.1474	-20.0501	-16.6023	-15.4727	-13.2401	-12.4105	-13.1973	-13.6987	-16.1493	-18.2952	-21.2491	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	180.5863	159.0042	168.3059	147.6639	142.4796	127.6456	125.9627	131.8644	134.1275	150.2292	160.0914	178.7282	(64)
										Total per year (kWh/year) = Sum(64)m =		1806.6889	(64)
12Total per year (kWh/year)												1807	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	63.1820	55.6452	58.7591	51.0295	48.9409	43.5173	42.6249	44.7437	45.6682	51.5735	55.5293	62.4414	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.8308	67.3484	60.8308	62.8585	60.8308	62.8585	60.8308	60.8308	62.8585	60.8308	62.8585	60.8308	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	84.9220	82.8054	78.9772	70.8742	65.7807	60.4408	57.2916	60.1394	63.4281	69.3192	77.1240	83.9266	(72)
Total internal gains	311.4800	317.1160	303.6578	290.9564	275.4710	261.2974	250.8688	252.4815	260.9103	274.3999	292.5966	305.2328	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.7100	19.6403	0.6300	0.7000	0.7700	40.2756	(76)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	44.4772	87.0068	143.2878	208.9768	256.1089	262.1730	249.5994	214.4022	166.6497	103.2409	55.4578	36.5759	(83)

Total gains	355.9571	404.1228	446.9456	499.9332	531.5798	523.4704	500.4682	466.8837	427.5600	377.6408	348.0544	341.8086	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8163	60.1088	60.3983	61.7963	62.0651	63.3476	63.3476	63.5910	62.8474	62.0651	61.5237	60.9678	
alpha	4.9878	5.0073	5.0266	5.1198	5.1377	5.2232	5.2232	5.2394	5.1898	5.1377	5.1016	5.0645	
util living area													
	0.9851	0.9713	0.9386	0.8436	0.6857	0.4943	0.3593	0.4003	0.6373	0.8902	0.9704	0.9875	(86)
MIT	19.9291	20.1322	20.4154	20.7502	20.9290	20.9896	20.9984	20.9972	20.9635	20.7147	20.2836	19.9141	(87)
Th 2	20.4434	20.4461	20.4488	20.4613	20.4636	20.4745	20.4745	20.4765	20.4703	20.4636	20.4589	20.4540	(88)
util rest of house													
	0.9829	0.9671	0.9300	0.8244	0.6544	0.4557	0.3168	0.3555	0.5955	0.8718	0.9655	0.9856	(89)
MIT 2	19.4394	19.6421	19.9211	20.2490	20.4094	20.4679	20.4737	20.4751	20.4455	20.2230	19.8033	19.4331	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	19.8035	20.0065	20.2887	20.6217	20.7958	20.8558	20.8638	20.8633	20.8307	20.5886	20.1605	19.7908	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8035	20.0065	20.2887	20.6217	20.7958	20.8558	20.8638	20.8633	20.8307	20.5886	20.1605	19.7908	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9799	0.9634	0.9272	0.8303	0.6740	0.4838	0.3483	0.3886	0.6242	0.8764	0.9624	0.9829	(94)
Useful gains	348.8055	389.3291	414.4291	415.1003	358.2754	253.2515	174.3139	181.4532	266.8856	330.9488	334.9767	335.9620	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	673.0329	652.6059	592.8209	492.5540	380.5561	256.4363	174.7818	182.2597	278.0978	417.9115	551.2421	664.0384	(97)
Space heating kWh													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98a)
Space heating requirement - total per year (kWh/year)												1087.7143	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1087.7143	
Space heating per m2											(98c) / (4) =	27.8901	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	241.2252	176.9220	132.7235	55.7667	16.5768	0.0000	0.0000	0.0000	0.0000	64.7002	155.7111	244.0888	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	261.0662	191.4740	143.6402	60.3535	17.9403	0.0000	0.0000	0.0000	0.0000	70.0219	168.5185	264.1654	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5863	159.0042	168.3059	147.6639	142.4796	127.6456	125.9627	131.8644	134.1275	150.2292	160.0914	178.7282	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.0025	84.6108	83.8775	82.4875	81.1178	80.3000	80.3000	80.3000	80.3000	82.7086	84.3220	85.0497	(217)
Fuel for water heating, kWh/month													
	212.4481	187.9242	200.6567	179.0137	175.6452	158.9609	156.8651	164.2147	167.0330	181.6368	189.8573	210.1456	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	12.6394	10.1398	9.1298	6.6889	5.1667	4.2212	4.7132	6.1264	7.9576	10.4408	11.7929	12.9907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.5051	-11.4259	-17.7250	-21.5712	-24.7560	-23.6831	-23.4153	-21.3606	-18.0067	-13.7752	-8.5514	-6.3952	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0121	-4.3759	-8.9665	-13.8670	-18.7247	-18.9396	-18.6975	-15.6360	-11.2211	-6.3662	-2.7219	-1.5795	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1177.1799	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2184.4014	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												102.0075	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-321.2788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3228.3100	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1177.1799	0.2100	247.2078	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2184.4014	0.2100	458.7243	(264)
Space and water heating			705.9321	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	102.0075	0.1443	14.7228	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	0.1330	-26.3533	
PV Unit electricity exported	-123.1080	0.1251	-15.3980	
Total			-41.7513	(269)
Total CO2, kg/year			690.8329	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.7100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1177.1799	1.1300	1330.2133	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2184.4014	1.1300	2468.3736	(278)
Space and water heating			3798.5869	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	102.0075	1.5338	156.4624	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	1.4914	-295.5498	
PV Unit electricity exported	-123.1080	0.4591	-56.5166	
Total			-352.0664	(283)
Total Primary energy kWh/year			3733.0837	(286)
Target Primary Energy Rate (TPER)			95.7200	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 8	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	86 B	**DER**	10.06	**TER**	12.55
Environmental	92 A	**% DER < TER**			19.84
CO_2 Emissions (t/year)	0.74	**DFEE**	24.46	**TFEE**	31.17
Compliance Check	See BREL	**% DFEE < TFEE**			21.55
% DPER < TPER	11.07	**DPER**	59.63	**TPER**	67.06

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	81.0000 (1b)	x	2.6000 (2b)	=	210.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	210.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			23.9100	0.7752	18.5349			(27)
EXTERNAL	79.9200	26.2500	53.6700	0.1400	7.5138	70.0000	3756.9000	(29a)
External Roof 1	14.8900		14.8900	0.1000	1.4890	9.0000	134.0100	(30)
Total net area of external elements Aum(A, m2)			94.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4097			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			81.0000			40.0000	3240.0000	(32d)
Party Ceiling 1			66.1100			30.0000	1983.3000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12942.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	159.7878 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.6600	0.0500	0.6330	
E3 Sill	7.0000	0.0400	0.2800	
E4 Jamb	31.1800	0.0500	1.5590	
E7 Party floor between dwellings (in blocks of flats)	48.5600	0.0700	3.3992	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	
E14 Flat roof	12.9200	0.0800	1.0336	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				7.9188 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	37.3285 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.8938	19.6332	19.3726	18.0695	17.8089	16.5058	16.5058	16.2452	17.0270	17.8089	18.3301	18.8513	(38)
Heat transfer coeff	57.2223	56.9617	56.7011	55.3980	55.1373	53.8343	53.8343	53.5736	54.3555	55.1373	55.6586	56.1798	(39)
Average = Sum(39)m / 12 =												55.3328	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7064	0.7032	0.7000	0.6839	0.6807	0.6646	0.6646	0.6614	0.6711	0.6807	0.6871	0.6936	(40)
HLP (average)												0.6831	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4816 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
74.0558	72.9428	71.3211	68.2182	65.9284	63.3747	61.9232	63.5327	65.2970	68.0388	71.2083	73.7720	(42a)

Hot water usage for baths

28.4311	28.0089	27.4143	26.3179	25.4970	24.5867	24.0950	24.6855	25.3284	26.3024	27.4213	28.3350	(42b)

Hot water usage for other uses

40.0437	38.5875	37.1314	35.6753	34.2191	32.7630	32.7630	34.2191	35.6753	37.1314	38.5875	40.0437	(42c)

Average daily hot water use (litres/day) 131.0404 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	142.5306	139.5393	135.8668	130.2114	125.6445	120.7245	118.7813	122.4373	126.3006	131.4726	137.2172	142.1507	(44)
Energy conte	225.7336	198.7021	208.8222	178.2529	169.1416	148.4448	143.6557	151.6030	155.7413	178.4071	195.4911	222.5736	(45)
Energy content (annual)										Total = Sum(45)m =		2176.5688	
Distribution loss (46)m = 0.15 x (45)m	33.8600	29.8053	31.3233	26.7379	25.3712	22.2667	21.5483	22.7404	23.3612	26.7611	29.3237	33.3860	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	276.6925	244.7295	259.7811	227.5680	220.1005	197.7599	194.6146	202.5619	205.0563	229.3660	244.8061	273.5325	(62)
WWHRS	-57.1024	-50.5019	-52.8826	-43.7889	-40.8097	-34.9211	-32.7330	-34.8083	-36.1308	-42.5942	-48.2540	-56.0450	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	219.5900	194.2276	206.8985	183.7791	179.2908	162.8387	161.8816	167.7536	168.9256	186.7718	196.5521	217.4876	(64)
										Total per year (kWh/year) = Sum(64)m =		2245.9969	(64)
12Total per year (kWh/year)												2246	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	87.7961	77.5753	82.1731	71.5979	68.9793	61.6867	60.5052	63.1477	64.1127	72.0601	77.3295	86.7455	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.7303	123.7014	111.7303	115.4546	111.7303	115.4546	111.7303	111.7303	115.4546	111.7303	115.4546	111.7303	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.5178	223.8165	218.0239	205.6923	190.1258	175.4954	165.7215	163.4228	169.2154	181.5470	197.1135	211.7439	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	(71)
Water heating gains (Table 5)	118.0056	115.4394	110.4477	99.4415	92.7141	85.6759	81.3242	84.8760	89.0455	96.8549	107.4021	116.5934	(72)
Total internal gains	514.4771	526.1807	503.4254	483.8118	457.7936	436.8494	418.9994	420.2525	433.9389	453.3557	483.1938	503.2910	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
South	12.1300	46.7521	0.5700	0.7000	0.7700	156.8078	(78)
West	0.3600	19.6403	0.5700	0.7000	0.7700	1.9550	(80)

Solar gains	209.5740	359.4352	497.4638	624.5001	705.9008	703.3476	677.0600	616.1182	541.5187	398.8627	251.4887	179.0382	(83)
Total gains	724.0511	885.6159	1000.8891	1108.3119	1163.6944	1140.1970	1096.0594	1036.3707	975.4577	852.2184	734.6824	682.3292	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.8291	63.1166	63.4067	64.8981	65.2049	66.7832	66.7832	67.1081	66.1428	65.2049	64.5943	63.9950	
alpha	5.1886	5.2078	5.2271	5.3265	5.3470	5.4522	5.4522	5.4739	5.4095	5.3470	5.3063	5.2663	
util living area	0.9300	0.8532	0.7472	0.5877	0.4375	0.3019	0.2161	0.2377	0.3831	0.6441	0.8623	0.9423	(86)
MIT	20.6735	20.7371	20.7832	20.8154	20.8242	20.8292	20.8294	20.8300	20.8274	20.8132	20.7512	20.6658	(87)
Th 2	20.3351	20.3380	20.3408	20.3551	20.3579	20.3722	20.3722	20.3751	20.3665	20.3579	20.3522	20.3465	(88)
util rest of house	0.9198	0.8359	0.7232	0.5596	0.4082	0.2724	0.1853	0.2055	0.3484	0.6103	0.8431	0.9335	(89)
MIT 2	19.9367	20.0157	20.0717	20.1213	20.1331	20.1531	20.1532	20.1569	20.1453	20.1226	20.0477	19.9384	(90)
Living area fraction										fLA = Living area / (4) =		0.3457	(91)
MIT	20.1914	20.2651	20.3177	20.3613	20.3720	20.3868	20.3870	20.3896	20.3811	20.3613	20.2909	20.1898	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1914	20.2651	20.3177	20.3613	20.3720	20.3868	20.3870	20.3896	20.3811	20.3613	20.2909	20.1898	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9174	0.8339	0.7224	0.5599	0.4088	0.2731	0.1860	0.2062	0.3492	0.6105	0.8411	0.9312	(94)
Useful gains	664.2124	738.5307	723.0052	620.5569	475.7179	311.3374	203.8505	213.7077	340.6519	520.2554	617.9737	635.4041	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	909.3429	875.2194	783.4761	634.9313	478.1495	311.5292	203.8678	213.7377	341.4111	538.2132	734.1867	898.3051	(97)
Space heating kWh	182.3771	91.8548	44.9903	10.3495	1.8091	0.0000	0.0000	0.0000	0.0000	13.3605	83.6734	195.5983	(98a)
Space heating requirement - total per year (kWh/year)												624.0131	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	182.3771	91.8548	44.9903	10.3495	1.8091	0.0000	0.0000	0.0000	0.0000	13.3605	83.6734	195.5983	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												624.0131	
Space heating per m2											(98c) / (4) =	7.7039	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 84.1000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	182.3771	91.8548	44.9903	10.3495	1.8091	0.0000	0.0000	0.0000	0.0000	13.3605	83.6734	195.5983	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	216.8574	109.2209	53.4963	12.3062	2.1511	0.0000	0.0000	0.0000	0.0000	15.8865	99.4928	232.5783	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	219.5900	194.2276	206.8985	183.7791	179.2908	162.8387	161.8816	167.7536	168.9256	186.7718	196.5521	217.4876	(64)
Efficiency of water heater												80.5000	(216)
(217)m	84.1868	83.0745	81.9121	80.9164	80.5777	80.5000	80.5000	80.5000	80.5000	81.0221	82.8889	84.3553	(217)
Fuel for water heating, kWh/month	260.8368	233.7992	252.5858	227.1222	222.5068	202.2841	201.0951	208.3896	209.8454	230.5196	237.1272	257.8232	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	29.9113	27.0167	29.9113	28.9464	29.9113	28.9464	29.9113	29.9113	28.9464	29.9113	28.9464	29.9113	(231)
Lighting	28.9620	23.2344	20.9200	15.3269	11.8389	9.6725	10.7999	14.0381	18.2341	23.9241	27.0222	29.7669	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 741.9895 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 80.5000
Water heating fuel used 2743.9351 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)
mechanical ventilation fans (SFP = 1.0360) 266.1816 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 352.1816 (231)
Electricity for lighting (calculated in Appendix L) 233.7398 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4071.8459	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	741.9895	0.2100	155.8178	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2743.9351	0.2100	576.2264	(264)
Space and water heating			732.0442	(265)
Pumps, fans and electric keep-hot	352.1816	0.1387	48.8519	(267)
Energy for lighting	233.7398	0.1443	33.7359	(268)
Total CO2, kg/year			814.6320	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.0600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	741.9895	1.1300	838.4481	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2743.9351	1.1300	3100.6467	(278)
Space and water heating			3939.0947	(279)
Pumps, fans and electric keep-hot	352.1816	1.5128	532.7803	(281)
Energy for lighting	233.7398	1.5338	358.5179	(282)
Total Primary energy kWh/year			4830.3929	(286)
Dwelling Primary energy Rate (DPER)			59.6300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		81.0000	(1b)	x 2.6000	(2b) =	210.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3925	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3925	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5004	0.4906	0.4808	0.4317	0.4219	0.3728	0.3728	0.3630	0.3925	0.4219	0.4415	0.4611	(22b)
Effective ac	0.6252	0.6203	0.6156	0.5932	0.5890	0.5695	0.5695	0.5659	0.5770	0.5890	0.5975	0.6063	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			17.9100	1.1450	20.5076			(27)

EXTERNAL	79.9200	20.2500	59.6700	0.1800	10.7406	(29a)
External Roof 1	14.8900		14.8900	0.1100	1.6379	(30)
Total net area of external elements Aum(A, m2)			94.8100			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2261	(33)
Main dwelling						
Party Wall 1			21.2700	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 167.9495 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.6600	0.0500	0.6330
E3 Sill	7.0000	0.0500	0.3500
E4 Jamb	31.1800	0.0500	1.5590
E7 Party floor between dwellings (in blocks of flats)	48.5600	0.0700	3.3992
E16 Corner (normal)	7.8000	0.0900	0.7020
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000
E14 Flat roof	12.9200	0.0800	1.0336

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9888 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.2149 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4492	43.1114	42.7803	41.2248	40.9338	39.5791	39.5791	39.3283	40.1009	40.9338	41.5225	42.1380	(38)
Heat transfer coeff	86.6642	86.3263	85.9952	84.4398	84.1488	82.7941	82.7941	82.5432	83.3159	84.1488	84.7375	85.3530	(39)
Average = Sum(39)m / 12 =												84.4384	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0699	1.0658	1.0617	1.0425	1.0389	1.0221	1.0221	1.0191	1.0286	1.0389	1.0461	1.0537	(40)
HLP (average)												1.0424	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4816 (42)

Hot water usage for mixer showers

65.8273	64.8381	63.3965	60.6384	58.6030	56.3331	55.0429	56.4735	58.0417	60.4789	63.2963	65.5751	(42a)

Hot water usage for baths

28.4311	28.0089	27.4143	26.3179	25.4970	24.5867	24.0950	24.6855	25.3284	26.3024	27.4213	28.3350	(42b)

Hot water usage for other uses

40.0437	38.5875	37.1314	35.6753	34.2191	32.7630	32.7630	34.2191	35.6753	37.1314	38.5875	40.0437	(42c)

Average daily hot water use (litres/day) 123.4541 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	134.3021	131.4345	127.9422	122.6316	118.3191	113.6828	111.9009	115.3781	119.0454	123.9127	129.3052	133.9538	(44)
Energy conte	212.7018	187.1610	196.6424	167.8766	159.2803	139.7863	135.3345	142.8622	146.7949	168.1484	184.2189	209.7393	(45)
Energy content (annual)										Total = Sum(45)m =		2050.5464	
Distribution loss (46)m = 0.15 x (45)m	31.9053	28.0741	29.4964	25.1815	23.8920	20.9679	20.3002	21.4293	22.0192	25.2223	27.6328	31.4609	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	263.6607	233.1884	247.6013	217.1916	210.2392	189.1014	186.2934	193.8211	196.1099	219.1073	233.5340	260.6982	(62)
WWHRS	-30.0935	-26.6149	-27.8696	-23.0772	-21.5071	-18.4038	-17.2506	-18.3443	-19.0412	-22.4475	-25.4303	-29.5362	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	233.5672	206.5734	219.7317	194.1145	188.7321	170.6976	169.0428	175.4768	177.0687	196.6598	208.1036	231.1620	(64)
										Total per year (kWh/year) = Sum(64)m =		2370.9301	(64)
12Total per year (kWh/year)												2371	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	83.4631	73.7379	78.1233	68.1477	65.7004	58.8077	57.7384	60.2414	61.1381	68.6491	73.5816	82.4780	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.7521	123.7256	111.7521	115.4772	111.7521	115.4772	111.7521	111.7521	115.4772	111.7521	115.4772	111.7521	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.5178	223.8165	218.0239	205.6923	190.1258	175.4954	165.7215	163.4228	169.2154	181.5470	197.1135	211.7439	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	(71)
Water heating gains (Table 5)	112.1815	109.7290	105.0045	94.6496	88.3070	81.6774	77.6054	80.9696	84.9140	92.2703	102.1966	110.8576	(72)
Total internal gains	508.6749	520.4945	498.0040	479.0425	453.4083	432.8734	415.3025	416.3680	429.8300	448.7928	478.0108	497.5770	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3700	10.6334	0.6300	0.7000	0.7700	10.9515	(74)

East			5.1800		19.6403		0.6300		0.7000		0.7700		31.0920 (76)
South			9.0900		46.7521		0.6300		0.7000		0.7700		129.8783 (78)
West			0.2700		19.6403		0.6300		0.7000		0.7700		1.6206 (80)
Solar gains	173.5424	297.6289	411.9016	517.0582	584.4315	582.3087	560.5486	510.1093	448.3687	330.2706	208.2489	148.2578	(83)
Total gains	682.2173	818.1234	909.9056	996.1007	1037.8398	1015.1821	975.8510	926.4773	878.1987	779.0635	686.2597	645.8348	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.6035	43.7742	43.9427	44.7522	44.9069	45.6417	45.6417	45.7804	45.3559	44.9069	44.5950	44.2734	
alpha	3.9069	3.9183	3.9295	3.9835	3.9938	4.0428	4.0428	4.0520	4.0237	3.9938	3.9730	3.9516	
util living area	0.9713	0.9443	0.9006	0.8094	0.6746	0.5032	0.3689	0.4032	0.6080	0.8434	0.9476	0.9760	(86)
MIT	19.5696	19.8735	20.2191	20.6044	20.8485	20.9649	20.9921	20.9887	20.9245	20.5993	20.0325	19.5291	(87)
Th 2	20.0255	20.0289	20.0323	20.0481	20.0511	20.0649	20.0649	20.0675	20.0596	20.0511	20.0451	20.0388	(88)
util rest of house	0.9654	0.9336	0.8820	0.7761	0.6234	0.4361	0.2925	0.3244	0.5391	0.8079	0.9357	0.9711	(89)
MIT 2	18.3781	18.7591	19.1855	19.6518	19.9196	20.0419	20.0615	20.0623	20.0050	19.6600	18.9747	18.3365	(90)
Living area fraction										fLA = Living area / (4) =		0.3457	(91)
MIT	18.7900	19.1444	19.5428	19.9811	20.2407	20.3610	20.3832	20.3825	20.3229	19.9847	19.3404	18.7488	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7900	19.1444	19.5428	19.9811	20.2407	20.3610	20.3832	20.3825	20.3229	19.9847	19.3404	18.7488	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9557	0.9216	0.8711	0.7736	0.6341	0.4578	0.3188	0.3514	0.5591	0.8051	0.9248	0.9623	(94)
Useful gains	651.9739	754.0155	792.5749	770.5698	658.0765	464.7728	311.0688	325.5286	491.0440	627.2563	634.6444	621.4710	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1255.7616	1229.6627	1121.6203	935.6852	718.6876	476.9740	313.2262	328.7309	518.4655	789.7088	1037.2209	1241.7812	(97)
Space heating kWh	449.2181	319.6349	244.8098	118.8831	45.0947	0.0000	0.0000	0.0000	0.0000	120.8646	289.8551	461.5108	(98a)
Space heating requirement - total per year (kWh/year)												2049.8710	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	449.2181	319.6349	244.8098	118.8831	45.0947	0.0000	0.0000	0.0000	0.0000	120.8646	289.8551	461.5108	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2049.8710	
Space heating per m2											(98c) / (4) =	25.3070	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	449.2181	319.6349	244.8098	118.8831	45.0947	0.0000	0.0000	0.0000	0.0000	120.8646	289.8551	461.5108	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	486.1668	345.9252	264.9457	128.6613	48.8037	0.0000	0.0000	0.0000	0.0000	130.8059	313.6960	499.4705	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	233.5672	206.5734	219.7317	194.1145	188.7321	170.6976	169.0428	175.4768	177.0687	196.6598	208.1036	231.1620	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.7581	85.3131	84.6136	83.3630	81.8266	80.3000	80.3000	80.3000	80.3000	83.3699	85.0915	85.8322	(217)
Fuel for water heating, kWh/month	272.3556	242.1356	259.6884	232.8544	230.6489	212.5748	210.5140	218.5266	220.5090	235.8881	244.5646	269.3184	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.2199	18.6279	16.7723	12.2881	9.4917	7.7548	8.6586	11.2548	14.6189	19.1808	21.6647	23.8652	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.2641	-23.0615	-35.4930	-42.8185	-48.7685	-46.4737	-45.9024	-42.0283	-35.6857	-27.6052	-17.3175	-13.0228	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5025	-9.7576	-19.9433	-30.7839	-41.5376	-42.0502	-41.5626	-34.8107	-25.0182	-14.2269	-6.0963	-3.5400	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2218.4751	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2849.5783	(219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	187.3978	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-667.2713	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4674.1800	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2218.4751	0.2100	465.8798	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2849.5783	0.2100	598.4115	(264)
Space and water heating			1064.2912	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	187.3978	0.1443	27.0473	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-393.4414	0.1332	-52.3936	
PV Unit electricity exported	-273.8300	0.1251	-34.2563	
Total			-86.6499	(269)
Total CO2, kg/year			1016.6179	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2218.4751	1.1300	2506.8769	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2849.5783	1.1300	3220.0235	(278)
Space and water heating			5726.9004	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	187.3978	1.5338	287.4370	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-393.4414	1.4921	-587.0474	
PV Unit electricity exported	-273.8300	0.4592	-125.7334	
Total			-712.7808	(283)
Total Primary energy kWh/year			5431.6575	(286)
Target Primary Energy Rate (TPER)			67.0600	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 9	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	85 B	**DER**	11.75	**TER**	14.46
Environmental	91 B	**% DER < TER**			18.74
CO_2 Emissions (t/year)	0.66	**DFEE**	25.82	**TFEE**	32.96
Compliance Check	See BREL	**% DFEE < TFEE**			21.67
% DPER < TPER	11.02	**DPER**	69.03	**TPER**	77.58

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000 (1b)	x	2.6000 (2b)	=	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			15.6000	0.7752	12.0930			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1400	5.3466	70.0000	2673.3000	(29a)
External Roof 1	37.4500		37.4500	0.1000	3.7450	9.0000	337.0500	(30)
Total net area of external elements Aum(A, m2)			93.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.0566			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			23.5500			30.0000	706.5000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12059.0500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.6893	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100	
E3 Sill	4.0300	0.0400	0.1612	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	26.9500	0.0700	1.8865	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.7800	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	1.4400	0.1200	0.1728	
E14 Flat roof	16.2300	0.0800	1.2984	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.1199 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	29.1765 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.9818	14.7855	14.5892	13.6079	13.4116	12.4303	12.4303	12.2340	12.8228	13.4116	13.8041	14.1967	(38)
Heat transfer coeff	44.1583	43.9620	43.7657	42.7844	42.5881	41.6068	41.6068	41.4105	41.9993	42.5881	42.9807	43.3732	(39)
Average = Sum(39)m / 12 =												42.7353	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7239	0.7207	0.7175	0.7014	0.6982	0.6821	0.6821	0.6789	0.6885	0.6982	0.7046	0.7110	(40)
HLP (average)												0.7006	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 115.2889 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.3976	122.7662	119.5355	114.5599	110.5421	106.2135	104.5036	107.7199	111.1185	115.6688	120.7229	125.0633	(44)
Energy conte	198.5991	174.8175	183.7216	156.8267	148.8109	130.6019	126.3880	133.3797	137.0202	156.9614	171.9919	195.8189	(45)
Energy content (annual)											Total = Sum(45)m =	1914.9379	
Distribution loss (46)m = 0.15 x (45)m	29.7899	26.2226	27.5582	23.5240	22.3216	19.5903	18.9582	20.0070	20.5530	23.5442	25.7988	29.3728	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	249.5580	220.8449	234.6805	206.1418	199.7698	179.9170	177.3469	184.3386	186.3353	207.9203	221.3070	246.7778	(62)
WWHRS	-50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	199.3177	176.4120	188.1529	167.6151	163.8643	149.1924	148.5475	153.7133	154.5465	170.4448	178.8518	197.4679	(64)
										Total per year (kWh/year) = Sum(64)m =		2048.1262	(64)
12Total per year (kWh/year)												2048	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	78.7739	69.6337	73.8272	64.4737	62.2193	55.7539	54.7637	57.0885	57.8880	64.9294	69.5161	77.8495	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	105.8789	103.6215	99.2300	89.5467	83.6281	77.4360	73.6072	76.7318	80.4000	87.2707	96.5501	104.6364	(72)
Total internal gains	425.9816	435.0265	416.5652	400.0640	378.8655	361.0346	346.5142	347.8181	359.0243	375.7129	400.2722	416.9973	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	538.2841	635.7242	712.0628	794.5439	841.7540	828.5391	794.0196	743.9238	689.1927	603.5552	536.5966	511.8787	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8575	76.1962	76.5379	78.2934	78.6542	80.5093	80.5093	80.8909	79.7569	78.6542	77.9359	77.2305	
alpha	6.0572	6.0797	6.1025	6.2196	6.2436	6.3673	6.3673	6.3927	6.3171	6.2436	6.1957	6.1487	
util living area	0.9550	0.9005	0.8053	0.6350	0.4683	0.3212	0.2305	0.2560	0.4195	0.7022	0.9027	0.9631	(86)
MIT	20.7166	20.7682	20.8118	20.8425	20.8497	20.8536	20.8536	20.8542	20.8521	20.8396	20.7837	20.7113	(87)
Th 2	20.3198	20.3226	20.3254	20.3396	20.3425	20.3567	20.3567	20.3595	20.3510	20.3425	20.3368	20.3311	(88)
util rest of house	0.9465	0.8848	0.7808	0.6040	0.4359	0.2890	0.1968	0.2204	0.3804	0.6653	0.8849	0.9560	(89)
MIT 2	19.9751	20.0399	20.0929	20.1403	20.1501	20.1688	20.1689	20.1725	20.1614	20.1409	20.0734	19.9796	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	20.2790	20.3384	20.3875	20.4281	20.4368	20.4495	20.4495	20.4519	20.4445	20.4273	20.3645	20.2795	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2790	20.3384	20.3875	20.4281	20.4368	20.4495	20.4495	20.4519	20.4445	20.4273	20.3645	20.2795	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9460	0.8852	0.7831	0.6082	0.4405	0.2937	0.2017	0.2255	0.3860	0.6702	0.8857	0.9554	(94)
Useful gains	509.2055	562.7636	557.6389	483.2642	370.8108	243.3070	160.1613	167.7805	266.0598	404.4877	475.2659	489.0445	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	705.6036	678.7027	607.7986	493.2218	372.0837	243.3774	160.1661	167.7901	266.4641	418.5257	570.1185	697.4178	(97)
Space heating kWh	146.1202	77.9111	37.3188	7.1695	0.9470	0.0000	0.0000	0.0000	0.0000	10.4442	68.2938	155.0297	(98a)
Space heating requirement - total per year (kWh/year)												503.2343	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	146.1202	77.9111	37.3188	7.1695	0.9470	0.0000	0.0000	0.0000	0.0000	10.4442	68.2938	155.0297	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												503.2343	
Space heating per m2										(98c) / (4) =		8.2497	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 84.1000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	146.1202	77.9111	37.3188	7.1695	0.9470	0.0000	0.0000	0.0000	0.0000	10.4442	68.2938	155.0297	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	173.7457	92.6410	44.3744	8.5250	1.1261	0.0000	0.0000	0.0000	0.0000	12.4188	81.2055	184.3397	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	199.3177	176.4120	188.1529	167.6151	163.8643	149.1924	148.5475	153.7133	154.5465	170.4448	178.8518	197.4679	(64)
Efficiency of water heater												80.5000	(216)
(217)m	83.9266	82.9528	81.8069	80.8200	80.5447	80.5000	80.5000	80.5000	80.5000	80.9511	82.7059	84.0687	(217)
Fuel for water heating, kWh/month	237.4906	212.6654	229.9963	207.3932	203.4452	185.3322	184.5311	190.9482	191.9832	210.5527	216.2503	234.8886	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	24.3293	21.9748	24.3293	23.5445	24.3293	23.5445	24.3293	24.3293	23.5445	24.3293	23.5445	24.3293	(231)
Lighting	21.8087	17.4957	15.7530	11.5413	8.9148	7.2835	8.1324	10.5708	13.7304	18.0151	20.3480	22.4148	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 598.3761 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 80.5000
Water heating fuel used 2505.4771 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)
mechanical ventilation fans (SFP = 1.0360) 200.4577 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 286.4577 (231)
Electricity for lighting (calculated in Appendix L) 176.0085 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3566.3194	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	598.3761	0.2100	125.6590	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2505.4771	0.2100	526.1502	(264)
Space and water heating			651.8092	(265)
Pumps, fans and electric keep-hot	286.4577	0.1387	39.7352	(267)
Energy for lighting	176.0085	0.1443	25.4035	(268)
Total CO2, kg/year			716.9479	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.7500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	598.3761	1.1300	676.1650	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2505.4771	1.1300	2831.1891	(278)
Space and water heating			3507.3541	(279)
Pumps, fans and electric keep-hot	286.4577	1.5128	433.3532	(281)
Energy for lighting	176.0085	1.5338	269.9678	(282)
Total Primary energy kWh/year			4210.6751	(286)
Dwelling Primary energy Rate (DPER)			69.0300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)

TER Opening Type			12.9100	1.1450	14.7824	(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584	(29a)
External Roof 1	37.4500		37.4500	0.1100	4.1195	(30)
Total net area of external elements Aum(A, m2)			93.5800			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.6003	(33)
Main dwelling						
Party Wall 1			32.7900	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.5500 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100
E3 Sill	4.0300	0.0500	0.2015
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	26.9500	0.0700	1.8865
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680
E18 Party wall between dwellings	10.4000	0.0600	0.6240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.7800	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	1.4400	0.1200	0.1728
E14 Flat roof	16.2300	0.0800	1.2984

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1602 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 34.7605 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	66.9471	66.7135	66.4844	65.4086	65.2073	64.2703	64.2703	64.0968	64.6312	65.2073	65.6145	66.0402	(39)

Average = Sum(39)m / 12 = 65.4076

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0975	1.0937	1.0899	1.0723	1.0690	1.0536	1.0536	1.0508	1.0595	1.0690	1.0756	1.0826	(40)
HLP (average)												1.0723	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 108.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.1691	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	238.0923	210.6907	223.9644	197.0124	191.0935	172.2990	169.2359	176.6483	178.4640	198.8945	211.3894	235.4858	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
									Total per year (kWh/year) = Sum(64)m =			2157.2560	(64)
12Total per year (kWh/year)												2157	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	74.9616	66.2574	70.2641	61.4381	59.3345	53.2209	52.1320	54.5314	55.2708	61.9283	66.2185	74.0949	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	100.7548	98.5973	94.4409	85.3307	79.7506	73.9179	70.0699	73.2949	76.7650	83.2370	91.9701	99.5899	(72)
Total internal gains	421.0597	430.2262	411.9783	396.0569	375.1902	357.7256	343.1791	344.5834	355.5982	371.8814	395.9012	412.1530	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

				W/m2	or Table 6b		or Table 6c		Table 6d				
North				2.1200	10.6334		0.6300		0.7000		0.7700	6.8894	(74)
East				7.0400	19.6403		0.6300		0.7000		0.7700	42.2563	(76)
South				3.7500	46.7521		0.6300		0.7000		0.7700	53.5801	(78)
Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	523.7855	613.8049	682.2621	756.8684	798.5671	785.3233	752.4852	706.8799	657.5911	580.2867	520.5996	498.9440	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.0127	51.1914	51.3677	52.2126	52.3738	53.1373	53.1373	53.2812	52.8406	52.3738	52.0487	51.7132	
alpha	4.4008	4.4128	4.4245	4.4808	4.4916	4.5425	4.5425	4.5521	4.5227	4.4916	4.4699	4.4475	
util living area	0.9808	0.9619	0.9252	0.8353	0.6913	0.5102	0.3730	0.4125	0.6355	0.8754	0.9633	0.9841	(86)
MIT	19.7316	19.9839	20.3003	20.6640	20.8851	20.9774	20.9956	20.9931	20.9406	20.6406	20.1341	19.6976	(87)
Th 2	20.0029	20.0060	20.0091	20.0235	20.0263	20.0389	20.0389	20.0412	20.0340	20.0263	20.0208	20.0150	(88)
util rest of house	0.9761	0.9529	0.9081	0.8011	0.6362	0.4388	0.2929	0.3287	0.5609	0.8406	0.9531	0.9801	(89)
MIT 2	18.5484	18.8662	19.2575	19.6951	19.9316	20.0254	20.0373	20.0385	19.9941	19.6824	19.0692	18.5143	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	19.0333	19.3243	19.6849	20.0922	20.3224	20.4156	20.4300	20.4297	20.3820	20.0751	19.5057	18.9992	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0333	19.3243	19.6849	20.0922	20.3224	20.4156	20.4300	20.4297	20.3820	20.0751	19.5057	18.9992	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9701	0.9454	0.9016	0.8037	0.6536	0.4672	0.3257	0.3630	0.5887	0.8426	0.9465	0.9747	(94)
Useful gains	508.1157	580.3033	615.1212	608.2706	521.9726	366.9375	245.1203	256.6112	387.1546	488.9385	492.7350	486.3425	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	986.3534	962.2920	876.5901	732.0635	562.2444	373.7674	246.1570	258.2936	406.0140	617.8469	813.9924	977.3441	(97)
Space heating kWh	355.8088	256.6964	194.5328	89.1309	29.9623	0.0000	0.0000	0.0000	0.0000	95.9079	231.3053	365.3052	(98a)
Space heating requirement - total per year (kWh/year)												1618.6496	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	355.8088	256.6964	194.5328	89.1309	29.9623	0.0000	0.0000	0.0000	0.0000	95.9079	231.3053	365.3052	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1618.6496	
Space heating per m2											(98c) / (4) =	26.5352	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	355.8088	256.6964	194.5328	89.1309	29.9623	0.0000	0.0000	0.0000	0.0000	95.9079	231.3053	365.3052	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	385.0745	277.8100	210.5334	96.4620	32.4267	0.0000	0.0000	0.0000	0.0000	103.7964	250.3304	395.3520	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	211.6152	187.2742	199.4439	176.7085	172.1709	156.1068	154.0583	160.5085	161.7110	179.1445	189.0151	209.4990	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.4856	85.0575	84.3280	82.9918	81.4682	80.3000	80.3000	80.3000	80.3000	83.1032	84.8152	85.5602	(217)
Fuel for water heating, kWh/month	247.5448	220.1737	236.5097	212.9229	211.3351	194.4045	191.8535	199.8860	201.3836	215.5688	222.8553	244.8556	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1751.7853	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	2599.2935	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4083.3018	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1751.7853	0.2100	367.8749	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2599.2935	0.2100	545.8516	(264)
Space and water heating			913.7265	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			881.8490	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.4600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1751.7853	1.1300	1979.5174	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2599.2935	1.1300	2937.2016	(278)
Space and water heating			4916.7191	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4732.4813	(286)
Target Primary Energy Rate (TPER)			77.5800	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 10	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	84 B	**DER**	13.14	**TER**	15.91
Environmental	91 B	**% DER < TER**			17.41
CO_2 Emissions (t/year)	0.61	**DFEE**	27.58	**TFEE**	34.39
Compliance Check	See BREL	**% DFEE < TFEE**			19.80
% DPER < TPER	10.42	**DPER**	76.70	**TPER**	85.62

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		130.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			16.3200	0.7752	12.6512			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1400	4.4534	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
External Roof 1	13.1000		13.1000	0.1000	1.3100	9.0000	117.9000	(30)
Total net area of external elements Aum(A, m2)			71.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.3552			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			36.9000			30.0000	1107.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 8797.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	175.9440	(35)
List of Thermal Bridges		

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150	
E3 Sill	6.6300	0.0400	0.2652	
E4 Jamb	22.8600	0.0500	1.1430	
E7 Party floor between dwellings (in blocks of flats)	35.1600	0.0700	2.4612	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000	
E14 Flat roof	9.9800	0.0800	0.7984	
P4 Party wall - Roof (insulation at ceiling level)	1.5100	0.1200	0.1812	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.1440	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	27.4992	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.2801	12.1193	11.9584	11.1540	10.9931	10.1887	10.1887	10.0279	10.5105	10.9931	11.3149	11.6366	(38)
Heat transfer coeff	39.7793	39.6184	39.4575	38.6532	38.4923	37.6879	37.6879	37.5270	38.0097	38.4923	38.8140	39.1358	(39)
Average = Sum(39)m / 12 =												38.6129	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7956	0.7924	0.7892	0.7731	0.7698	0.7538	0.7538	0.7505	0.7602	0.7698	0.7763	0.7827	(40)
HLP (average)												0.7723	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 104.6166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7893	111.4018	108.4704	103.9553	100.3096	96.3818	94.8299	97.7482	100.8321	104.9611	109.5474	113.4859	(44)
Energy conte	180.2144	158.6347	166.7150	142.3097	135.0360	118.5126	114.6885	121.0327	124.3360	142.4312	156.0703	177.6915	(45)
Energy content (annual)											Total = Sum(45)m =	1737.6727	
Distribution loss (46)m = 0.15 x (45)m	27.0322	23.7952	25.0072	21.3465	20.2554	17.7769	17.2033	18.1549	18.6504	21.3647	23.4105	26.6537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	47.5307	48.3243	49.8114	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	231.1733	204.6621	217.6739	191.6247	185.9949	166.0434	163.0128	170.8441	173.6511	193.3901	205.3854	228.6504	(62)
WWHRS	-45.5909	-40.3210	-42.2218	-34.9613	-32.5827	-27.8812	-26.1342	-27.7911	-28.8470	-34.0074	-38.5263	-44.7466	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	185.5824	164.3412	175.4521	156.6634	153.4122	138.1621	136.8786	143.0530	144.8041	159.3826	166.8591	183.9038	(64)
										Total per year (kWh/year) = Sum(64)m =		1908.4946	(64)
12Total per year (kWh/year)												1908	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	72.6610	64.2529	68.1724	59.6467	57.6392	51.2881	50.2150	52.6962	53.6705	60.0981	64.2222	71.8222	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	97.6627	95.6144	91.6296	82.8427	77.4720	71.2335	67.4933	70.8283	74.5424	80.7770	89.1974	96.5352	(72)
Total internal gains	370.5107	377.9470	362.1555	347.6476	329.4551	312.9678	300.2558	302.0630	312.1025	327.0581	348.3004	362.8869	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	503.7441	614.0839	704.0477	793.6089	842.7224	826.8006	793.9961	746.1086	690.7346	593.6507	509.6931	475.6621	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4306	61.6801	61.9316	63.2204	63.4846	64.8395	64.8395	65.1175	64.2907	63.4846	62.9583	62.4407	
alpha	5.0954	5.1120	5.1288	5.2147	5.2323	5.3226	5.3226	5.3412	5.2860	5.2323	5.1972	5.1627	
util living area	0.9276	0.8518	0.7396	0.5734	0.4220	0.2914	0.2088	0.2313	0.3783	0.6438	0.8615	0.9398	(86)
MIT	20.6670	20.7304	20.7794	20.8120	20.8205	20.8251	20.8252	20.8258	20.8233	20.8083	20.7440	20.6585	(87)
Th 2	20.2572	20.2600	20.2627	20.2767	20.2795	20.2936	20.2936	20.2964	20.2880	20.2795	20.2739	20.2683	(88)
util rest of house	0.9159	0.8326	0.7128	0.5424	0.3901	0.2594	0.1753	0.1960	0.3398	0.6060	0.8400	0.9298	(89)
MIT 2	19.8530	19.9311	19.9897	20.0388	20.0500	20.0693	20.0694	20.0729	20.0617	20.0388	19.9624	19.8537	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	20.2763	20.3468	20.4004	20.4409	20.4507	20.4623	20.4624	20.4644	20.4577	20.4390	20.3688	20.2722	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2763	20.3468	20.4004	20.4409	20.4507	20.4623	20.4624	20.4644	20.4577	20.4390	20.3688	20.2722	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9162	0.8349	0.7180	0.5495	0.3977	0.2670	0.1833	0.2044	0.3490	0.6146	0.8430	0.9299	(94)
Useful gains	461.5405	512.7269	505.4975	436.1262	335.1608	220.7932	145.5525	152.5013	241.0452	364.8282	429.6518	442.2966	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	635.5249	611.9758	548.4738	446.0904	336.8333	220.9374	145.5667	152.5265	241.6558	378.7247	515.0160	628.9984	(97)
Space heating kWh	129.4444	66.6952	31.9743	7.1742	1.2443	0.0000	0.0000	0.0000	0.0000	10.3390	61.4622	138.9061	(98a)
Space heating requirement - total per year (kWh/year)												447.2398	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	129.4444	66.6952	31.9743	7.1742	1.2443	0.0000	0.0000	0.0000	0.0000	10.3390	61.4622	138.9061	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												447.2398	
Space heating per m2											(98c) / (4) =	8.9448	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 84.1000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	129.4444	66.6952	31.9743	7.1742	1.2443	0.0000	0.0000	0.0000	0.0000	10.3390	61.4622	138.9061	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	153.9172	79.3047	38.0194	8.5306	1.4795	0.0000	0.0000	0.0000	0.0000	12.2937	73.0823	165.1678	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	185.5824	164.3412	175.4521	156.6634	153.4122	138.1621	136.8786	143.0530	144.8041	159.3826	166.8591	183.9038	(64)
Efficiency of water heater												80.5000	(216)
(217)m	83.8245	82.8073	81.7158	80.8417	80.5626	80.5000	80.5000	80.5000	80.5000	80.9761	82.6474	83.9883	(217)
Fuel for water heating, kWh/month	221.3940	198.4622	214.7101	193.7904	190.4261	171.6300	170.0355	177.7056	179.8808	196.8267	201.8927	218.9636	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	21.2592	19.2018	21.2592	20.5734	21.2592	20.5734	21.2592	21.2592	20.5734	21.2592	20.5734	21.2592	(231)
Lighting	17.4563	14.0041	12.6091	9.2380	7.1357	5.8299	6.5094	8.4612	10.9902	14.4198	16.2871	17.9414	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 531.7952 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 80.5000
Water heating fuel used 2335.7177 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)
mechanical ventilation fans (SFP = 1.0360) 164.3096 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 250.3096 (231)
Electricity for lighting (calculated in Appendix L) 140.8820 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3258.7045	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	531.7952	0.2100	111.6770	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2335.7177	0.2100	490.5007	(264)
Space and water heating			602.1777	(265)
Pumps, fans and electric keep-hot	250.3096	0.1387	34.7210	(267)
Energy for lighting	140.8820	0.1443	20.3336	(268)
Total CO2, kg/year			657.2324	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.1400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	531.7952	1.1300	600.9286	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2335.7177	1.1300	2639.3610	(278)
Space and water heating			3240.2897	(279)
Pumps, fans and electric keep-hot	250.3096	1.5128	378.6684	(281)
Energy for lighting	140.8820	1.5338	216.0894	(282)
Total Primary energy kWh/year			3835.0475	(286)
Dwelling Primary energy Rate (DPER)			76.7000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)

TER Opening Type			10.1500	1.1450	11.6221	(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364	(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796	(29a)
External Roof 1	13.1000		13.1000	0.1100	1.4410	(30)
Total net area of external elements Aum(A, m2)			71.7900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.7191	(33)
Main dwelling						
Party Wall 1			15.3900	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3240 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	35.1600	0.0700	2.4612
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000
E14 Flat roof	9.9800	0.0800	0.7984
P4 Party wall - Roof (insulation at ceiling level)	1.5100	0.1200	0.1812

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2103 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	29.9294 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	57.0664	56.8456	56.6291	55.6124	55.4222	54.5367	54.5367	54.3727	54.8778	55.4222	55.8070	56.2093	(39)
Average = Sum(39)m / 12 =												55.6115	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1413	1.1369	1.1326	1.1122	1.1084	1.0907	1.0907	1.0875	1.0976	1.1084	1.1161	1.1242	(40)
HLP (average)												1.1122	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6901 (42)
Hot water usage for mixer showers	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556 (42a)
Hot water usage for baths	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)
Hot water usage for other uses	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	48.2812	48.1363	44.7582	45.5249	46.9393	46.8688	50.4112	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.7687	195.4477	207.9495	182.3063	175.2988	156.3578	153.5698	160.9934	164.0619	184.6518	196.3856	218.4034	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
									Total per year (kWh/year) = Sum(64)m =			1992.9475	(64)
12Total per year (kWh/year)												1993	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	69.2015	61.1891	64.9391	56.6337	54.3156	48.2964	47.3061	49.6578	50.6839	57.2378	61.2297	68.4150	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	93.0127	91.0552	87.2837	78.6579	73.0049	67.0784	63.5835	66.7444	70.3943	76.9325	85.0413	91.9557	(72)
Total internal gains	366.2732	373.8444	358.2220	343.8889	325.4004	309.2388	296.7585	298.3915	308.3807	323.6261	344.5705	358.7198	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

					W/m2	or Table 6b		or Table 6c		Table 6d			
East					5.7800	19.6403		0.6300		0.7000	0.7700	34.6934	(76)
South					3.7000	46.7521		0.6300		0.7000	0.7700	52.8657	(78)
West					0.6700	19.6403		0.6300		0.7000	0.7700	4.0216	(80)
Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	457.8540	536.1596	593.2344	650.4414	678.2217	662.4500	636.1575	603.6283	568.6491	506.8768	455.5074	436.2380	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6176	44.7910	44.9622	45.7842	45.9413	46.6872	46.6872	46.8280	46.3971	45.9413	45.6245	45.2980	
alpha	3.9745	3.9861	3.9975	4.0523	4.0628	4.1125	4.1125	4.1219	4.0931	4.0628	4.0416	4.0199	
util living area	0.9710	0.9472	0.9058	0.8154	0.6803	0.5083	0.3729	0.4079	0.6177	0.8504	0.9485	0.9754	(86)
MIT	19.6160	19.8899	20.2259	20.6094	20.8518	20.9661	20.9925	20.9892	20.9246	20.6013	20.0590	19.5820	(87)
Th 2	19.9672	19.9708	19.9743	19.9908	19.9939	20.0084	20.0084	20.0111	20.0028	19.9939	19.9877	19.9811	(88)
util rest of house	0.9646	0.9360	0.8863	0.7802	0.6255	0.4362	0.2909	0.3231	0.5437	0.8131	0.9357	0.9698	(89)
MIT 2	18.3869	18.7301	19.1440	19.6064	19.8692	19.9873	20.0055	20.0065	19.9507	19.6120	18.9582	18.3540	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	19.0260	19.3332	19.7066	20.1280	20.3801	20.4963	20.5187	20.5175	20.4572	20.1265	19.5306	18.9926	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0260	19.3332	19.7066	20.1280	20.3801	20.4963	20.5187	20.5175	20.4572	20.1265	19.5306	18.9926	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9572	0.9278	0.8806	0.7854	0.6473	0.4723	0.3334	0.3670	0.5785	0.8185	0.9287	0.9630	(94)
Useful gains	438.2485	497.4346	522.3777	510.8325	439.0426	312.8782	212.1082	221.5031	328.9615	414.8758	423.0426	420.0928	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	840.3608	820.4625	747.8760	624.4160	481.0723	321.5639	213.7132	223.8796	348.8662	527.9775	693.7135	831.4806	(97)
Space heating kWh	299.1715	217.0748	167.7707	81.7801	31.2701	0.0000	0.0000	0.0000	0.0000	84.1477	194.8830	306.0725	(98a)
Space heating requirement - total per year (kWh/year)												1382.1705	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	299.1715	217.0748	167.7707	81.7801	31.2701	0.0000	0.0000	0.0000	0.0000	84.1477	194.8830	306.0725	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1382.1705	
Space heating per m2											(98c) / (4) =	27.6434	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	299.1715	217.0748	167.7707	81.7801	31.2701	0.0000	0.0000	0.0000	0.0000	84.1477	194.8830	306.0725	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	323.7787	234.9294	181.5700	88.5066	33.8421	0.0000	0.0000	0.0000	0.0000	91.0689	210.9124	331.2473	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7418	174.1982	185.6982	163.8814	158.1275	141.6641	139.7968	146.3472	148.8593	166.7296	176.0819	194.8215	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.2767	84.8541	84.1645	82.9720	81.6033	80.3000	80.3000	80.3000	80.3000	82.9929	84.5994	85.3449	(217)
Fuel for water heating, kWh/month	230.7099	205.2915	220.6373	197.5141	193.7757	176.4186	174.0932	182.2506	185.3789	200.8962	208.1362	228.2755	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1495.8555	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	2403.3777	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3698.5604	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1495.8555	0.2100	314.1297	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2403.3777	0.2100	504.7093	(264)
Space and water heating			818.8390	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			795.3288	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.9100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1495.8555	1.1300	1690.3167	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2403.3777	1.1300	2715.8168	(278)
Space and water heating			4406.1335	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4280.9411	(286)
Target Primary Energy Rate (TPER)			85.6200	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 11	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	86 B	**DER**	9.72	**TER**	12.08
Environmental	91 B	**% DER < TER**			19.54
CO_2 Emissions (t/year)	0.89	**DFEE**	28.31	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			19.63
% DPER < TPER	10.57	**DPER**	57.52	**TPER**	64.32

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	104.0000	(1b)	x 2.6000	(2b) =	270.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	270.4000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			30.4700	0.7752	23.6202			(27)
EXTERNAL	107.7200	32.8100	74.9100	0.1400	10.4874	70.0000	5243.7000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
External Roof 1	37.7500		37.7500	0.1000	3.7750	9.0000	339.7500	(30)
Total net area of external elements Aum(A, m2)			153.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8232			(33)
Main dwelling								
Party Floor 1			104.0000			40.0000	4160.0000	(32d)
Party Ceiling 1			66.2500			30.0000	1987.5000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12306.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		118.3303 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	14.0800	0.0500	0.7040	
E3 Sill	7.8000	0.0400	0.3120	
E4 Jamb	29.9400	0.0500	1.4970	
E7 Party floor between dwellings (in blocks of flats)	63.2200	0.0700	4.4254	
E16 Corner (normal)	10.4000	0.0900	0.9360	
E18 Party wall between dwellings	2.6000	0.0600	0.1560	
E14 Flat roof	25.9400	0.0800	2.0752	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.8716 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.6948 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.5427	25.2080	24.8734	23.2003	22.8657	21.1926	21.1926	20.8580	21.8618	22.8657	23.5349	24.2042	(38)
Heat transfer coeff	76.2374	75.9028	75.5682	73.8951	73.5605	71.8874	71.8874	71.5527	72.5566	73.5605	74.2297	74.8989	(39)

Average = Sum(39)m / 12 = 73.8114

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7331	0.7298	0.7266	0.7105	0.7073	0.6912	0.6912	0.6880	0.6977	0.7073	0.7137	0.7202	(40)
HLP (average)												0.7097	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7736 (42)

Hot water usage for mixer showers

79.5644	78.3687	76.6263	73.2926	70.8324	68.0889	66.5294	68.2586	70.1541	73.0999	76.5052	79.2596	(42a)

Hot water usage for baths

30.5368	30.0833	29.4447	28.2671	27.3854	26.4077	25.8796	26.5138	27.2043	28.2504	29.4522	30.4336	(42b)

Hot water usage for other uses

43.0344	41.4695	39.9046	38.3398	36.7749	35.2100	35.2100	36.7749	38.3398	39.9046	41.4695	43.0344	(42c)

Average daily hot water use (litres/day) 140.7903 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	153.1356	149.9215	145.9756	139.8995	134.9927	129.7065	127.6190	131.5472	135.6981	141.2549	147.4269	152.7276	(44)
Energy conte	242.5294	213.4863	224.3591	191.5154	181.7261	159.4893	154.3441	162.8829	167.3293	191.6816	210.0367	239.1344	(45)
Energy content (annual)										Total = Sum(45)m =		2338.5147	
Distribution loss (46)m = 0.15 x (45)m	36.3794	32.0229	33.6539	28.7273	27.2589	23.9234	23.1516	24.4324	25.0994	28.7522	31.5055	35.8702	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	293.4883	259.5137	275.3180	240.8305	232.6850	208.8044	205.3030	213.8418	216.6444	242.6405	259.3518	290.0933	(62)
WWHRS	-61.3500	-54.2584	-56.8163	-47.0462	-43.8453	-37.5188	-35.1679	-37.3975	-38.8184	-45.7626	-51.8434	-60.2139	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	232.1383	205.2552	218.5017	193.7843	188.8397	171.2856	170.1351	176.4443	177.8260	196.8780	207.5083	229.8795	(64)
									Total per year (kWh/year) = Sum(64)m =			2368.4761	(64)
12Total per year (kWh/year)												2368	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	93.3808	82.4910	87.3391	76.0076	73.1637	65.3590	64.0591	66.8983	67.9658	76.4739	82.1660	92.2519	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.4701	146.6634	132.4701	136.8858	132.4701	136.8858	132.4701	132.4701	136.8858	132.4701	136.8858	132.4701	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)
Water heating gains (Table 5)	125.5118	122.7545	117.3913	105.5662	98.3382	90.7763	86.1010	89.9171	94.3969	102.7874	114.1194	123.9945	(72)
Total internal gains	588.2227	602.3841	575.9598	553.9297	523.8300	500.3377	479.6585	480.7492	496.5125	518.1081	552.3117	575.1173	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	13.8400	19.6403	0.5700	0.7000	0.7700	75.1605	(76)
South	11.7700	46.7521	0.5700	0.7000	0.7700	152.1540	(78)
West	0.3600	19.6403	0.5700	0.7000	0.7700	1.9550	(80)

Solar gains	242.5005	425.3284	608.8236	790.0984	910.8610	913.8620	877.2030	786.8322	672.1846	477.8736	292.8304	205.9211	(83)
Total gains	830.7232	1027.7124	1184.7834	1344.0280	1434.6910	1414.1997	1356.8614	1267.5814	1168.6971	995.9817	845.1422	781.0383	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.8393	45.0370	45.2364	46.2606	46.4710	47.5526	47.5526	47.7750	47.1140	46.4710	46.0521	45.6406	
alpha	3.9893	4.0025	4.0158	4.0840	4.0981	4.1702	4.1702	4.1850	4.1409	4.0981	4.0701	4.0427	
util living area	0.9282	0.8628	0.7682	0.6170	0.4646	0.3233	0.2327	0.2590	0.4210	0.6864	0.8738	0.9394	(86)
MIT	20.5130	20.5982	20.6749	20.7400	20.7649	20.7763	20.7775	20.7781	20.7717	20.7322	20.6225	20.5033	(87)
Th 2	20.3117	20.3146	20.3174	20.3315	20.3344	20.3486	20.3486	20.3514	20.3429	20.3344	20.3287	20.3230	(88)
util rest of house	0.9194	0.8484	0.7471	0.5898	0.4338	0.2910	0.1984	0.2227	0.3829	0.6547	0.8580	0.9317	(89)
MIT 2	19.7162	19.8232	19.9176	20.0063	20.0359	20.0622	20.0632	20.0670	20.0521	20.0022	19.8682	19.7150	(90)
Living area fraction										fLA = Living area / (4) =		0.2885	(91)
MIT	19.9460	20.0468	20.1361	20.2179	20.2462	20.2682	20.2693	20.2721	20.2597	20.2128	20.0858	19.9424	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9460	20.0468	20.1361	20.2179	20.2462	20.2682	20.2693	20.2721	20.2597	20.2128	20.0858	19.9424	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9142	0.8423	0.7412	0.5851	0.4297	0.2870	0.1942	0.2183	0.3780	0.6487	0.8517	0.9270	(94)
Useful gains	759.4445	865.6199	878.2185	786.3417	616.4687	405.8526	263.5432	276.6856	441.7331	646.0887	719.8355	724.0122	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1192.8144	1149.6811	1030.4534	836.3388	628.6589	407.4729	263.7729	277.0587	446.9252	707.1207	963.9284	1179.0901	(97)
Space heating kWh	322.4272	190.8891	113.2628	35.9979	9.0695	0.0000	0.0000	0.0000	0.0000	45.4078	175.7469	338.5779	(98a)
Space heating requirement - total per year (kWh/year)												1231.3792	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	322.4272	190.8891	113.2628	35.9979	9.0695	0.0000	0.0000	0.0000	0.0000	45.4078	175.7469	338.5779	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1231.3792	
Space heating per m2											(98c) / (4) =	11.8402	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 84.1000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	322.4272	190.8891	113.2628	35.9979	9.0695	0.0000	0.0000	0.0000	0.0000	45.4078	175.7469	338.5779	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	383.3855	226.9788	134.6763	42.8037	10.7842	0.0000	0.0000	0.0000	0.0000	53.9926	208.9737	402.5897	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	232.1383	205.2552	218.5017	193.7843	188.8397	171.2856	170.1351	176.4443	177.8260	196.8780	207.5083	229.8795	(64)
Efficiency of water heater												80.5000	(216)
(217)m	85.2861	84.4267	83.2430	81.7359	80.8577	80.5000	80.5000	80.5000	80.5000	81.9830	84.2280	85.4101	(217)
Fuel for water heating, kWh/month	272.1879	243.1165	262.4866	237.0858	233.5458	212.7772	211.3480	219.1855	220.9019	240.1448	246.3650	269.1478	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	36.3306	32.8148	36.3306	35.1587	36.3306	35.1587	36.3306	36.3306	35.1587	36.3306	35.1587	36.3306	(231)
Lighting	35.4793	28.4628	25.6276	18.7759	14.5030	11.8491	13.2301	17.1970	22.3373	29.3077	33.1030	36.4654	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 1464.1846 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 80.5000
Water heating fuel used 2868.2928 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)
mechanical ventilation fans (SFP = 1.0360) 341.7640 (230a)
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 427.7640 (231)
Electricity for lighting (calculated in Appendix L) 286.3381 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5046.5794	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1464.1846	0.2100	307.4788	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2868.2928	0.2100	602.3415	(264)
Space and water heating			909.8202	(265)
Pumps, fans and electric keep-hot	427.7640	0.1387	59.3361	(267)
Energy for lighting	286.3381	0.1443	41.3274	(268)
Total CO2, kg/year			1010.4838	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.7200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1464.1846	1.1300	1654.5285	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2868.2928	1.1300	3241.1708	(278)
Space and water heating			4895.6994	(279)
Pumps, fans and electric keep-hot	427.7640	1.5128	647.1213	(281)
Energy for lighting	286.3381	1.5338	439.1949	(282)
Total Primary energy kWh/year			5982.0156	(286)
Dwelling Primary energy Rate (DPER)			57.5200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	104.0000	(1b)	x 2.6000	(2b) =	270.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		270.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1479	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3979	(18)
Number of sides sheltered		0	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =		1.0000	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.3979	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5074	0.4974	0.4875	0.4377	0.4278	0.3780	0.3780	0.3681	0.3979	0.4278	0.4477	0.4676	(22b)
Effective ac	0.6287	0.6237	0.6188	0.5958	0.5915	0.5715	0.5715	0.5677	0.5792	0.5915	0.6002	0.6093	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			23.6600	1.1450	27.0916			(27)

EXTERNAL	107.7200	26.0000	81.7200	0.1800	14.7096	(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796	(29a)
External Roof 1	37.7500		37.7500	0.1100	4.1525	(30)
Total net area of external elements Aum(A, m2)			153.6900			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7733	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 124.7005 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.0800	0.0500	0.7040
E3 Sill	7.8000	0.0500	0.3900
E4 Jamb	29.9400	0.0500	1.4970
E7 Party floor between dwellings (in blocks of flats)	63.2200	0.0700	4.4254
E16 Corner (normal)	10.4000	0.0900	0.9360
E18 Party wall between dwellings	2.6000	0.0600	0.1560
E14 Flat roof	25.9400	0.0800	2.0752
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9496 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.7229 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1008	55.6548	55.2177	53.1644	52.7803	50.9920	50.9920	50.6608	51.6808	52.7803	53.5574	54.3699	(38)
Heat transfer coeff	115.8237	115.3777	114.9406	112.8873	112.5032	110.7149	110.7149	110.3837	111.4037	112.5032	113.2803	114.0928	(39)
Average = Sum(39)m / 12 =												112.8855	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1137	1.1094	1.1052	1.0855	1.0818	1.0646	1.0646	1.0614	1.0712	1.0818	1.0892	1.0970	(40)
HLP (average)												1.0854	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7736 (42)

Hot water usage for mixer showers

70.7239	69.6611	68.1123	65.1490	62.9622	60.5234	59.1373	60.6743	62.3592	64.9777	68.0046	70.4529	(42a)

Hot water usage for baths

30.5368	30.0833	29.4447	28.2671	27.3854	26.4077	25.8796	26.5138	27.2043	28.2504	29.4522	30.4336	(42b)

Hot water usage for other uses

43.0344	41.4695	39.9046	38.3398	36.7749	35.2100	35.2100	36.7749	38.3398	39.9046	41.4695	43.0344	(42c)

Average daily hot water use (litres/day) 132.6397 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.2951	141.2139	137.4616	131.7559	127.1224	122.1411	120.2268	123.9629	127.9032	133.1327	138.9264	143.9209	(44)
Energy conte	228.5282	201.0867	211.2734	180.3672	171.1312	150.1867	145.4039	153.4920	157.7174	180.6599	197.9261	225.3454	(45)
Energy content (annual)										Total = Sum(45)m =		2203.1181	
Distribution loss (46)m = 0.15 x (45)m	34.2792	30.1630	31.6910	27.0551	25.6697	22.5280	21.8106	23.0238	23.6576	27.0990	29.6889	33.8018	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	279.4871	247.1141	262.2323	229.6823	222.0901	199.5018	196.3628	204.4509	207.0325	231.6188	247.2411	276.3043	(62)
WWHRS	-32.3320	-28.5947	-29.9427	-24.7938	-23.1069	-19.7727	-18.5338	-19.7088	-20.4576	-24.1173	-27.3220	-31.7333	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	247.1551	218.5194	232.2895	204.8885	198.9832	179.7291	177.8290	184.7421	186.5749	207.5015	219.9192	244.5710	(64)
										Total per year (kWh/year) = Sum(64)m =		2502.7025	(64)
12Total per year (kWh/year)												2503	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	88.7254	78.3682	82.9881	72.3009	69.6409	62.2659	61.0865	63.7758	64.7698	72.8091	78.1392	87.6671	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.4429	146.6332	132.4429	136.8577	132.4429	136.8577	132.4429	132.4429	136.8577	132.4429	136.8577	132.4429	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)
Water heating gains (Table 5)	119.2545	116.6193	111.5432	100.4179	93.6033	86.4804	82.1055	85.7202	89.9581	97.8617	108.5266	117.8321	(72)
Total internal gains	581.9383	596.2187	570.0845	548.7532	519.0679	496.0136	475.6358	476.5251	492.0456	513.1552	546.6909	568.9276	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.4900	10.6334	0.6300	0.7000	0.7700	11.3415	(74)
East	10.7500	19.6403	0.6300	0.7000	0.7700	64.5249	(76)

South				9.1400	46.7521	0.6300	0.7000	0.7700				130.5927	(78)
West				0.2800	19.6403	0.6300	0.7000	0.7700				1.6806	(80)
Solar gains	208.1397	365.0634	522.5593	678.1439	781.7862	784.3571	752.8952	675.3376	576.9414	410.1639	251.3386	176.7431	(83)
Total gains	790.0780	961.2822	1092.6438	1226.8971	1300.8541	1280.3708	1228.5310	1151.8627	1068.9870	923.3190	798.0295	745.6708	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.1030	31.2232	31.3419	31.9120	32.0209	32.5381	32.5381	32.6358	32.3370	32.0209	31.8013	31.5748	
alpha	3.0735	3.0815	3.0895	3.1275	3.1347	3.1692	3.1692	3.1757	3.1558	3.1347	3.1201	3.1050	
util living area	0.9612	0.9320	0.8863	0.7967	0.6703	0.5120	0.3835	0.4219	0.6234	0.8392	0.9370	0.9667	(86)
MIT	18.9722	19.3380	19.7918	20.3237	20.6962	20.9071	20.9719	20.9618	20.8212	20.3113	19.5621	18.9253	(87)
Th 2	19.9897	19.9932	19.9966	20.0127	20.0158	20.0299	20.0299	20.0325	20.0244	20.0158	20.0096	20.0032	(88)
util rest of house	0.9548	0.9212	0.8685	0.7661	0.6226	0.4458	0.3039	0.3401	0.5578	0.8074	0.9252	0.9612	(89)
MIT 2	17.6356	18.0951	18.6591	19.3099	19.7348	19.9616	20.0155	20.0116	19.8815	19.3140	18.3939	17.5849	(90)
Living area fraction										fLA = Living area / (4) =		0.2885	(91)
MIT	18.0212	18.4536	18.9858	19.6024	20.0121	20.2344	20.2914	20.2857	20.1525	19.6017	18.7309	17.9716	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0212	18.4536	18.9858	19.6024	20.0121	20.2344	20.2914	20.2857	20.1525	19.6017	18.7309	17.9716	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9377	0.9003	0.8471	0.7519	0.6224	0.4603	0.3258	0.3621	0.5670	0.7920	0.9055	0.9455	(94)
Useful gains	740.8511	865.4465	925.5446	922.4536	809.6766	589.3322	400.2713	417.0432	606.0770	731.2251	722.6397	705.0401	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1589.2341	1563.7882	1435.1268	1208.1614	935.1399	623.8088	408.6915	428.9199	674.2758	1012.7147	1317.5470	1571.2373	(97)
Space heating kWh	631.1970	469.2856	379.1291	205.7096	93.3447	0.0000	0.0000	0.0000	0.0000	209.4282	428.3333	644.4507	(98a)
Space heating requirement - total per year (kWh/year)												3060.8783	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	631.1970	469.2856	379.1291	205.7096	93.3447	0.0000	0.0000	0.0000	0.0000	209.4282	428.3333	644.4507	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3060.8783	
Space heating per m2											(98c) / (4) =	29.4315	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	631.1970	469.2856	379.1291	205.7096	93.3447	0.0000	0.0000	0.0000	0.0000	209.4282	428.3333	644.4507	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	683.1136	507.8849	410.3129	222.6294	101.0224	0.0000	0.0000	0.0000	0.0000	226.6539	463.5642	697.4575	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.1551	218.5194	232.2895	204.8885	198.9832	179.7291	177.8290	184.7421	186.5749	207.5015	219.9192	244.5710	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.2993	85.9746	85.4242	84.3900	82.8595	80.3000	80.3000	80.3000	80.3000	84.4013	85.7832	86.3557	(217)
Fuel for water heating, kWh/month	286.3930	254.1673	271.9247	242.7876	240.1453	223.8220	221.4558	230.0648	232.3473	245.8511	256.3661	283.2135	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	27.5190	22.0768	19.8777	14.5633	11.2491	9.1906	10.2618	13.3387	17.3256	22.7321	25.6759	28.2839	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.3586	-29.1164	-44.6094	-53.5582	-60.7608	-57.8006	-57.0753	-52.3660	-44.6319	-34.7316	-21.9134	-16.5294	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-6.0208	-13.0217	-26.5680	-40.9436	-55.1878	-55.8598	-55.2254	-46.2916	-33.3089	-18.9788	-8.1487	-4.7365	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3312.6388	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2988.5386	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	222.0943	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-856.7434	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5752.5282	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3312.6388	0.2100	695.6541	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2988.5386	0.2100	627.5931	(264)
Space and water heating			1323.2472	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	222.0943	0.1443	32.0551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.4518	0.1333	-65.6268	
PV Unit electricity exported	-364.2917	0.1251	-45.5875	
Total			-111.2143	(269)
Total CO2, kg/year			1256.0173	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.0800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3312.6388	1.1300	3743.2818	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2988.5386	1.1300	3377.0486	(278)
Space and water heating			7120.3304	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	222.0943	1.5338	340.6556	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.4518	1.4925	-734.9602	
PV Unit electricity exported	-364.2917	0.4593	-167.3237	
Total			-902.2839	(283)
Total Primary energy kWh/year			6688.8029	(286)
Target Primary Energy Rate (TPER)			64.3200	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Lean - Flat 12	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	83 B	**DER**	14.35	**TER**	16.64
Environmental	89 B	**% DER < TER**			13.76
CO_2 Emissions (t/year)	0.81	**DFEE**	37.75	**TFEE**	44.47
Compliance Check	See BREL	**% DFEE < TFEE**			15.12
% DPER < TPER	7.14	**DPER**	82.94	**TPER**	89.31

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	64.0000	(1b)	x 2.6000	(2b) =	166.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.4000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			22.4300	0.7752	17.3876			(27)
EXTERNAL	91.8700	24.7700	67.1000	0.1400	9.3940	70.0000	4697.0000	(29a)
HALLWAY	9.7700		9.7700	0.1300	1.2701	70.0000	683.9000	(29a)
External Roof 1	64.0000		64.0000	0.1000	6.4000	9.0000	576.0000	(30)
Total net area of external elements Aum(A, m2)			165.6400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.3237			(33)
Main dwelling								
Party Floor 1			64.0000			40.0000	2560.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8516.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		133.0766 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.4000	0.0500	0.6200

E3 Sill	3.8000	0.0400	0.1520	
E4 Jamb	29.0400	0.0500	1.4520	
E7 Party floor between dwellings (in blocks of flats)	36.3000	0.0700	2.5410	
E16 Corner (normal)	14.0000	0.0900	1.2600	
E18 Party wall between dwellings	2.8000	0.0600	0.1680	
E14 Flat roof	36.3000	0.0800	2.9040	
E17 Corner (inverted - internal area greater than external area)	2.8000	-0.0900	-0.2520	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.8450	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	45.1687	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7186	15.5126	15.3067	14.2771	14.0712	13.0416	13.0416	12.8357	13.4534	14.0712	14.4830	14.8949	(38)
Heat transfer coeff	60.8873	60.6813	60.4754	59.4458	59.2399	58.2103	58.2103	58.0044	58.6221	59.2399	59.6517	60.0636	(39)
Average = Sum(39)m / 12 =												59.3943	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9514	0.9481	0.9449	0.9288	0.9256	0.9095	0.9095	0.9063	0.9160	0.9256	0.9321	0.9385	(40)
HLP (average)												0.9280	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0922	(42)
Hot water usage for mixer showers	66.7109	65.7084	64.2475	61.4524	59.3896	57.0892	55.7817	57.2315	58.8208	61.2907	64.1459	66.4553	(42a)
Hot water usage for baths	25.6236	25.2430	24.7071	23.7191	22.9792	22.1588	21.7157	22.2478	22.8272	23.7051	24.7135	25.5369	(42b)
Hot water usage for other uses	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
Average daily hot water use (litres/day)												118.0405	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3905	125.6963	122.3884	117.2941	113.1803	108.7484	106.9978	110.2909	113.7707	118.4296	123.6043	128.0483	(44)
Energy conte	203.3392	178.9899	188.1064	160.5697	152.3624	133.7189	129.4045	136.5631	140.2906	160.7078	176.0970	200.4927	(45)
Energy content (annual)										Total = Sum(45)m =		1960.6423	
Distribution loss (46)m = 0.15 x (45)m	30.5009	26.8485	28.2160	24.0855	22.8544	20.0578	19.4107	20.4845	21.0436	24.1062	26.4145	30.0739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	254.2981	225.0173	239.0653	209.8848	203.3213	183.0339	180.3634	187.5220	189.6057	211.6667	225.4121	251.4516	(62)
WWHRS	-51.4390	-45.4931	-47.6378	-39.4459	-36.7622	-31.4577	-29.4866	-31.3560	-32.5473	-38.3697	-43.4682	-50.4865	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	202.8591	179.5242	191.4276	170.4388	166.5591	151.5763	150.8769	156.1660	157.0584	173.2970	181.9438	200.9651	(64)
										Total per year (kWh/year) = Sum(64)m =		2082.6923	(64)
12Total per year (kWh/year)												2083	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	80.3500	71.0210	75.2851	65.7182	63.4002	56.7903	55.7667	58.1470	58.9754	66.1751	70.8810	79.4035	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.2575	102.1422	92.2575	95.3327	92.2575	95.3327	92.2575	92.2575	95.3327	92.2575	95.3327	92.2575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	107.9973	105.6860	101.1897	91.2753	85.2154	78.8754	74.9553	78.1545	81.9103	88.9450	98.4459	106.7252	(72)
Total internal gains	440.5483	450.0197	430.8556	413.8340	391.8454	373.5002	358.4343	359.7355	371.3495	388.4914	413.9211	431.2056	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.3600	10.6334	0.5700	0.7000	0.7700	1.0585	(74)
East	16.9500	19.6403	0.5700	0.7000	0.7700	92.0499	(76)
West	5.1200	19.6403	0.5700	0.7000	0.7700	27.8050	(80)

Solar gains	120.9134	236.4844	389.5621	568.6612	697.5867	714.4526	680.0414	583.6578	453.2119	280.6163	150.7507	99.4452	(83)
Total gains	561.4616	686.5041	820.4177	982.4952	1089.4321	1087.9528	1038.4757	943.3933	824.5614	669.1077	564.6718	530.6509	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	38.8555	38.9874	39.1201	39.7977	39.9360	40.6424	40.6424	40.7867	40.3569	39.9360	39.6603	39.3884	
alpha	3.5904	3.5992	3.6080	3.6532	3.6624	3.7095	3.7095	3.7191	3.6905	3.6624	3.6440	3.6259	
util living area	0.9432	0.8960	0.8083	0.6501	0.4842	0.3382	0.2456	0.2810	0.4719	0.7520	0.9055	0.9514	(86)
MIT	20.3991	20.4878	20.5928	20.6897	20.7309	20.7473	20.7499	20.7500	20.7384	20.6672	20.5208	20.3882	(87)
Th 2	20.1241	20.1268	20.1295	20.1431	20.1458	20.1594	20.1594	20.1621	20.1539	20.1458	20.1403	20.1349	(88)
util rest of house	0.9345	0.8816	0.7848	0.6164	0.4445	0.2951	0.1991	0.2305	0.4193	0.7151	0.8898	0.9438	(89)
MIT 2	19.3968	19.5085	19.6372	19.7611	19.8071	19.8371	19.8390	19.8423	19.8239	19.7424	19.5641	19.3934	(90)
Living area fraction									fLA = Living area / (4) =			0.4062	(91)
MIT	19.8040	19.9064	20.0254	20.1383	20.1824	20.2069	20.2091	20.2111	20.1954	20.1181	19.9528	19.7975	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8040	19.9064	20.0254	20.1383	20.1824	20.2069	20.2091	20.2111	20.1954	20.1181	19.9528	19.7975	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8776	0.7818	0.6162	0.4462	0.2976	0.2019	0.2335	0.4219	0.7139	0.8860	0.9405	(94)
Useful gains	522.6635	602.4626	641.4086	605.4103	486.1400	323.7432	209.6373	220.2898	347.8898	477.6528	500.3028	499.0788	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	943.9931	910.6065	817.9536	668.0710	502.4947	326.3775	210.0841	221.0577	357.3271	563.8539	766.6907	936.8427	(97)
Space heating kWh	313.4693	207.0727	131.3495	45.1157	12.1678	0.0000	0.0000	0.0000	0.0000	64.1336	191.7993	325.6963	(98a)
Space heating requirement - total per year (kWh/year)												1290.8042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	313.4693	207.0727	131.3495	45.1157	12.1678	0.0000	0.0000	0.0000	0.0000	64.1336	191.7993	325.6963	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1290.8042	
Space heating per m2										(98c) / (4) =		20.1688	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	84.1000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	313.4693	207.0727	131.3495	45.1157	12.1678	0.0000	0.0000	0.0000	0.0000	64.1336	191.7993	325.6963	(98)
Space heating efficiency (main heating system 1)	84.1000	84.1000	84.1000	84.1000	84.1000	0.0000	0.0000	0.0000	0.0000	84.1000	84.1000	84.1000	(210)
Space heating fuel (main heating system)	372.7340	246.2220	156.1825	53.6453	14.4683	0.0000	0.0000	0.0000	0.0000	76.2588	228.0610	387.2727	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	202.8591	179.5242	191.4276	170.4388	166.5591	151.5763	150.8769	156.1660	157.0584	173.2970	181.9438	200.9651	(64)
Efficiency of water heater												80.5000	(216)
(217)m	85.5108	84.8887	83.7911	82.1598	81.0325	80.5000	80.5000	80.5000	80.5000	82.6550	84.6952	85.6101	(217)
Fuel for water heating, kWh/month	237.2320	211.4818	228.4581	207.4480	205.5462	188.2935	187.4247	193.9951	195.1036	209.6631	214.8219	234.7447	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	25.1666	22.7311	25.1666	24.3548	25.1666	24.3548	25.1666	25.1666	24.3548	25.1666	24.3548	25.1666	(231)
Lighting	22.9597	18.4192	16.5844	12.1504	9.3854	7.6679	8.5616	11.1287	14.4551	18.9659	21.4219	23.5979	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1534.8445	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.5000	
Water heating fuel used	2514.2126	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	210.3163	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	296.3163	(231)
Electricity for lighting (calculated in Appendix L)	185.2982	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4530.6716	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1534.8445	0.2100	322.3173	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2514.2126	0.2100	527.9846	(264)
Space and water heating			850.3020	(265)
Pumps, fans and electric keep-hot	296.3163	0.1387	41.1027	(267)
Energy for lighting	185.2982	0.1443	26.7443	(268)
Total CO2, kg/year			918.1490	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			14.3500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1534.8445	1.1300	1734.3743	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2514.2126	1.1300	2841.0602	(278)
Space and water heating			4575.4345	(279)
Pumps, fans and electric keep-hot	296.3163	1.5128	448.2673	(281)
Energy for lighting	185.2982	1.5338	284.2166	(282)
Total Primary energy kWh/year			5307.9184	(286)
Dwelling Primary energy Rate (DPER)			82.9400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	64.0000	(1b) x	2.6000	(2b) =	166.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	166.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1202	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3702	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3702	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4720	0.4627	0.4535	0.4072	0.3980	0.3517	0.3517	0.3424	0.3702	0.3980	0.4165	0.4350	(22b)
Effective ac	0.6114	0.6071	0.6028	0.5829	0.5792	0.5618	0.5618	0.5586	0.5685	0.5792	0.5867	0.5946	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			13.6600	1.1450	15.6412			(27)
EXTERNAL	91.8700	16.0000	75.8700	0.1800	13.6566			(29a)
HALLWAY	9.7700		9.7700	0.1800	1.7586			(29a)

External Roof 1	64.0000	64.0000	0.1100	7.0400	(30)
Total net area of external elements Aum(A, m2)		165.6400			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		40.4364	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 133.0766 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.4000	0.0500	0.6200
E3 Sill	3.8000	0.0500	0.1900
E4 Jamb	29.0400	0.0500	1.4520
E7 Party floor between dwellings (in blocks of flats)	36.3000	0.0700	2.5410
E16 Corner (normal)	14.0000	0.0900	1.2600
E18 Party wall between dwellings	2.8000	0.0600	0.1680
E14 Flat roof	36.3000	0.0800	2.9040
E17 Corner (inverted - internal area greater than external area)	2.8000	-0.0900	-0.2520

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8830 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 49.3194 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.5726	33.3351	33.1023	32.0088	31.8042	30.8518	30.8518	30.6754	31.2186	31.8042	32.2181	32.6508	(38)
Heat transfer coeff	82.8921	82.6545	82.4217	81.3282	81.1236	80.1712	80.1712	79.9948	80.5381	81.1236	81.5375	81.9702	(39)
Average = Sum(39)m / 12 =												81.3272	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2952	1.2915	1.2878	1.2708	1.2676	1.2527	1.2527	1.2499	1.2584	1.2676	1.2740	1.2808	(40)
HLP (average)												1.2707	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0922 (42)

Hot water usage for mixer showers

59.2986	58.4075	57.1089	54.6243	52.7908	50.7460	49.5837	50.8725	52.2852	54.4806	57.0186	59.0714	(42a)

Hot water usage for baths

25.6236	25.2430	24.7071	23.7191	22.9792	22.1588	21.7157	22.2478	22.8272	23.7051	24.7135	25.5369	(42b)

Hot water usage for other uses

36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)

Average daily hot water use (litres/day) 111.2066 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.9782	118.3954	115.2498	110.4660	106.5815	102.4052	100.7998	103.9318	107.2350	111.6195	116.4770	120.6644	(44)
Energy conte	191.5999	168.5935	177.1346	151.2224	143.4791	125.9191	121.9086	128.6893	132.2315	151.4666	165.9428	188.9313	(45)
Energy content (annual)										Total = Sum(45)m =		1847.1187	
Distribution loss (46)m = 0.15 x (45)m	28.7400	25.2890	26.5702	22.6834	21.5219	18.8879	18.2863	19.3034	19.8347	22.7200	24.8914	28.3397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	242.5588	214.6208	228.0936	200.5375	194.4380	175.2342	172.8675	179.6482	181.5466	202.4255	215.2579	239.8902	(62)
WWHRS	-27.1088	-23.9753	-25.1055	-20.7884	-19.3740	-16.5785	-15.5397	-16.5249	-17.1527	-20.2212	-22.9082	-26.6068	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	215.4500	190.6456	202.9880	179.7491	175.0640	158.6557	157.3278	163.1233	164.3939	182.2043	192.3497	213.2833	(64)
									Total per year (kWh/year) = Sum(64)m =			2195.2347	(64)
12Total per year (kWh/year)												2195	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	76.4467	67.5642	71.6370	62.6102	60.4465	54.1969	53.2743	55.5289	56.2957	63.1024	67.5047	75.5594	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.4146	102.3162	92.4146	95.4951	92.4146	95.4951	92.4146	92.4146	95.4951	92.4146	95.4951	92.4146	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	102.7509	100.5419	96.2863	86.9587	81.2453	75.2734	71.6053	74.6356	78.1885	84.8150	93.7566	101.5583	(72)
Total internal gains	435.4591	445.0497	426.1094	409.6799	388.0325	370.0606	355.2415	356.3738	367.7902	384.5186	409.3942	426.1959	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.2200	10.6334	0.6300	0.7000	0.7700	0.7149	(74)
East	10.3200	19.6403	0.6300	0.7000	0.7700	61.9439	(76)
West	3.1200	19.6403	0.6300	0.7000	0.7700	18.7272	(80)

Solar gains	81.3861	159.1762	262.2121	382.7639	469.5449	480.8981	457.7356	392.8586	305.0548	188.8812	101.4694	66.9361	(83)
Total gains	516.8452	604.2259	688.3216	792.4438	857.5774	850.9587	812.9771	749.2325	672.8450	573.3998	510.8637	493.1320	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.5408	28.6228	28.7037	29.0896	29.1630	29.5094	29.5094	29.5745	29.3750	29.1630	29.0149	28.8618	
alpha	2.9027	2.9082	2.9136	2.9393	2.9442	2.9673	2.9673	2.9716	2.9583	2.9442	2.9343	2.9241	
util living area	0.9633	0.9424	0.9039	0.8205	0.6969	0.5413	0.4125	0.4590	0.6721	0.8686	0.9446	0.9676	(86)
MIT	18.7392	19.0563	19.5358	20.1426	20.5969	20.8646	20.9551	20.9378	20.7334	20.1116	19.3303	18.6954	(87)
Th 2	19.8446	19.8475	19.8504	19.8638	19.8663	19.8781	19.8781	19.8803	19.8736	19.8663	19.8612	19.8559	(88)
util rest of house	0.9565	0.9320	0.8864	0.7883	0.6438	0.4637	0.3155	0.3590	0.5980	0.8371	0.9328	0.9615	(89)
MIT 2	17.2455	17.6449	18.2428	18.9842	19.5024	19.7835	19.8572	19.8491	19.6664	18.9703	18.0045	17.1971	(90)
Living area fraction									fLA = Living area / (4) =			0.4062	(91)
MIT	17.8523	18.2183	18.7681	19.4548	19.9470	20.2227	20.3032	20.2914	20.0998	19.4339	18.5431	17.8058	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8523	18.2183	18.7681	19.4548	19.9470	20.2227	20.3032	20.2914	20.0998	19.4339	18.5431	17.8058	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9404	0.9128	0.8662	0.7752	0.6479	0.4886	0.3533	0.3971	0.6141	0.8228	0.9148	0.9465	(94)
Useful gains	486.0489	551.5461	596.2084	614.2714	555.6189	415.7942	287.2277	297.4893	413.1826	471.7925	467.3205	466.7600	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1123.3816	1100.8149	1011.1550	858.4028	669.0283	450.7813	296.8920	311.2902	483.2158	716.6415	933.0426	1115.2703	(97)
Space heating kWh	474.1755	369.1086	308.7202	175.7746	84.3766	0.0000	0.0000	0.0000	0.0000	182.1676	335.3199	482.4917	(98a)
Space heating requirement - total per year (kWh/year)												2412.1347	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	474.1755	369.1086	308.7202	175.7746	84.3766	0.0000	0.0000	0.0000	0.0000	182.1676	335.3199	482.4917	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2412.1347	
Space heating per m2											(98c) / (4) =	37.6896	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	474.1755	369.1086	308.7202	175.7746	84.3766	0.0000	0.0000	0.0000	0.0000	182.1676	335.3199	482.4917	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	513.1770	399.4682	334.1128	190.2323	91.3166	0.0000	0.0000	0.0000	0.0000	197.1511	362.9004	522.1771	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	215.4500	190.6456	202.9880	179.7491	175.0640	158.6557	157.3278	163.1233	164.3939	182.2043	192.3497	213.2833	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.0218	85.7714	85.2770	84.3335	82.9084	80.3000	80.3000	80.3000	80.3000	84.3810	85.5597	86.0742	(217)
Fuel for water heating, kWh/month	250.4598	222.2718	238.0336	213.1408	211.1535	197.5787	195.9251	203.1423	204.7246	215.9304	224.8134	247.7901	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	19.2019	15.4045	13.8701	10.1618	7.8493	6.4129	7.1604	9.3073	12.0893	15.8618	17.9158	19.7356	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1522	-18.4106	-28.4154	-34.3859	-39.2668	-37.4668	-37.0165	-33.8482	-28.6683	-22.0910	-13.8073	-10.3630	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4659	-7.5205	-15.3861	-23.7691	-32.0862	-32.4781	-32.0916	-26.8641	-19.2952	-10.9615	-4.6925	-2.7237	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2610.5354	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2624.9640	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)

Electricity for lighting (calculated in Appendix L)	154.9706	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-527.2267	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4949.2434	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2610.5354	0.2100	548.2124	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2624.9640	0.2100	551.2425	(264)
Space and water heating			1099.4549	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	154.9706	0.1443	22.3671	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-315.8921	0.1331	-42.0463	
PV Unit electricity exported	-211.3346	0.1251	-26.4348	
Total			-68.4811	(269)
Total CO2, kg/year			1065.2701	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.6400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2610.5354	1.1300	2949.9050	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2624.9640	1.1300	2966.2094	(278)
Space and water heating			5916.1144	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	154.9706	1.5338	237.6991	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-315.8921	1.4918	-471.2612	
PV Unit electricity exported	-211.3346	0.4591	-97.0257	
Total			-568.2869	(283)
Total Primary energy kWh/year			5715.6274	(286)
Target Primary Energy Rate (TPER)			89.3100	(287)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Shop 1, 13 Bedford Road Improved NO PV

As designed

Date: Wed Feb 26 10:24:31 2025

Administrative information

Building Details

Address: 13 Bedford Road, Wood Green, LONDON, N22 7AU

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 139.02

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	4.85	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	6.17	
Target primary energy rate (TPER), kWh/m^2.annum	52.43	
Building primary energy rate (BPER), kWh/m^2.annum	69.16	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF/01 SHOP/East/Wall-External
Floors	0.18	0.1	0.12	GF/02 TOILETS/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.11	0.11	GF/01 SHOP/Roof
Windows** and roof windows	1.6	0.8	0.8	GF/01 SHOP/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3	3	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
GF/02 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF/01 SHOP	247	80	1.875
GF/02 TOILETS	601	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF/01 SHOP	YES (+13.4%)	NO
GF/02 TOILETS	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	139	139
External area [m^2]	343.6	343.6
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	62.17	123.88
Average U-value [W/m^2K]	0.18	0.36
Alpha value* [%]	37.97	20.88

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	5.94	10.5
Cooling	26.26	8.44
Auxiliary	0.32	0.43
Lighting	12.17	14.36
Hot water	1.65	1.65
Equipment*	20.24	20.24
TOTAL**	**46.35**	**35.39**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	261.14	233.52
Primary energy [kWh/m^2]	69.16	52.43
Total emissions [kg/m^2]	6.17	4.85

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	59.8	201.4	5.9	26.3	0.3	2.8	2.13	3	3
	Notional	99.8	133.7	10.5	8.4	0.4	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Shop 2, 13 Bedford Road Improved NO PV

As designed

Date: Wed Feb 26 10:22:36 2025

Administrative information

Building Details

Address: 13 Bedford Road, Wood Green, LONDON, N22 7AU

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 119.35

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	5.3	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	5.96	
Target primary energy rate (TPER), kWh/m^2.annum	56.91	
Building primary energy rate (BPER), kWh/m^2.annum	66.58	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF/01 SHOP/East/Wall-External
Floors	0.18	0.1	0.12	GF/02 TOILETS/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.11	0.11	GF/01 SHOP/Roof
Windows** and roof windows	1.6	0.8	0.8	GF/01 SHOP/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3	3	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
GF/02 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF/01 SHOP	300	80	1.875
GF/02 TOILETS	599	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF/01 SHOP	YES (+34%)	NO
GF/02 TOILETS	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	119.4	119.4
External area [m^2]	353.3	353.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	58.96	103.92
Average U-value [W/m^2K]	0.17	0.29
Alpha value* [%]	29.33	17.92

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	7.16	12.78
Cooling	24.3	6.79
Auxiliary	0.38	0.5
Lighting	11.1	16.56
Hot water	1.65	1.65
Equipment*	20.23	20.23
TOTAL**	**44.57**	**38.28**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	258.31	229.07
Primary energy [kWh/m^2]	66.58	56.91
Total emissions [kg/m^2]	5.96	5.3

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	72	186.3	7.2	24.3	0.4	2.8	2.13	3	3
	Notional	121.5	107.6	12.8	6.8	0.5	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

1c. Be Green SAP/SBEM Calculations

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 1	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	93 A	**DER**	1.58	**TER**	13.24
Environmental	99 A	**% DER < TER**			88.07
CO_2 Emissions (t/year)	0.08	**DFEE**	23.99	**TFEE**	29.08
Compliance Check	See BREL	**% DFEE < TFEE**			17.52
% DPER < TPER	72.20	**DPER**	19.75	**TPER**	71.05

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000 (1b)	x	2.6000 (2b)	=	158.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

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2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			15.6000	0.7752	12.0930			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1400	5.3466	70.0000	2673.3000	(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.3116			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			61.0000			30.0000	1830.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12845.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	210.5820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.3000	2.4600

E3 Sill	4.0300	0.0400	0.1612	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8348 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 27.1464 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.9818	14.7855	14.5892	13.6079	13.4116	12.4303	12.4303	12.2340	12.8228	13.4116	13.8041	14.1967	(38)
Heat transfer coeff	42.1282	41.9319	41.7356	40.7543	40.5580	39.5767	39.5767	39.3804	39.9692	40.5580	40.9506	41.3431	(39)

Average = Sum(39)m / 12 = 40.7052

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6906	0.6874	0.6842	0.6681	0.6649	0.6488	0.6488	0.6456	0.6552	0.6649	0.6713	0.6778	(40)
HLP (average)												0.6673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 115.2889 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.3976	122.7662	119.5355	114.5599	110.5421	106.2135	104.5036	107.7199	111.1185	115.6688	120.7229	125.0633	(44)
Energy conte	198.5991	174.8175	183.7216	156.8267	148.8109	130.6019	126.3880	133.3797	137.0202	156.9614	171.9919	195.8189	(45)

Energy content (annual) Total = Sum(45)m = 1914.9379

Distribution loss (46)m = 0.15 x (45)m

29.7899	26.2226	27.5582	23.5240	22.3216	19.5903	18.9582	20.0070	20.5530	23.5442	25.7988	29.3728	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.1340 (55)

Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

257.0155	227.5807	242.1380	213.3587	207.2273	187.1339	184.8044	191.7961	193.5522	215.3778	228.5239	254.2353	(62)
WWHRS -50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

206.7752	183.1478	195.6104	174.8321	171.3218	156.4093	156.0050	161.1708	161.7634	177.9023	186.0687	204.9254	(64)

Total per year (kWh/year) = Sum(64)m = 2135.9322 (64)

12Total per year (kWh/year) 2136 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

112.7673	100.3374	107.8206	97.3705	96.2127	88.6507	88.7571	91.0819	90.7848	98.9228	102.4129	111.8429	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	151.5690	149.3116	144.9201	135.2368	129.3182	123.1260	119.2972	122.4219	126.0900	132.9607	142.2402	150.3265	(72)
Total internal gains	468.6716	477.7165	459.2553	442.7540	421.5555	406.7247	392.2042	393.5081	404.7143	418.4030	442.9623	459.6873	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	580.9741	678.4143	754.7528	837.2340	884.4441	874.2292	839.7096	789.6139	734.8828	646.2452	579.2866	554.5688	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	84.6985	85.0950	85.4951	87.5538	87.9775	90.1590	90.1590	90.6083	89.2735	87.9775	87.1342	86.3069	
alpha	6.6466	6.6730	6.6997	6.8369	6.8652	7.0106	7.0106	7.0406	6.9516	6.8652	6.8089	6.7538	
util living area													
	0.9365	0.8675	0.7575	0.5824	0.4258	0.2897	0.2074	0.2294	0.3750	0.6401	0.8642	0.9466	(86)
Living	20.7712	20.8122	20.8423	20.8605	20.8638	20.8669	20.8669	20.8675	20.8657	20.8596	20.8248	20.7675	
Non living	20.0704	20.1213	20.1577	20.1913	20.1974	20.2155	20.2155	20.2191	20.2083	20.1937	20.1509	20.0772	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8830	20.8122	20.8423	20.8605	20.8638	20.8669	20.8669	20.8675	20.8657	20.8596	20.8248	20.8001	(87)
Th 2	20.3491	20.3520	20.3548	20.3691	20.3720	20.3863	20.3863	20.3892	20.3805	20.3720	20.3662	20.3605	(88)
util rest of house													
	0.9252	0.8488	0.7316	0.5537	0.3972	0.2619	0.1785	0.1989	0.3415	0.6048	0.8423	0.9368	(89)
MIT 2	20.2380	20.1213	20.1577	20.1913	20.1974	20.2155	20.2155	20.2191	20.2083	20.1937	20.1509	20.1283	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	20.5023	20.4045	20.4382	20.4656	20.4705	20.4825	20.4825	20.4849	20.4777	20.4666	20.4271	20.4036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5023	20.4045	20.4382	20.4656	20.4705	20.4825	20.4825	20.4849	20.4777	20.4666	20.4271	20.4036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9280	0.8504	0.7351	0.5581	0.4017	0.2663	0.1830	0.2037	0.3467	0.6102	0.8445	0.9375	(94)
Useful gains	539.1518	576.9448	554.7945	467.2461	355.3045	232.7939	153.6561	160.8618	254.8074	394.3630	489.2088	519.9100	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	682.5751	650.1323	581.7214	471.3464	355.7141	232.8099	153.6570	160.8635	254.9133	400.1714	545.7521	669.9068	(97)
Space heating kWh													
	106.7070	49.1820	20.0336	2.9523	0.3047	0.0000	0.0000	0.0000	0.0000	4.3214	40.7112	111.5977	(98a)
Space heating requirement - total per year (kWh/year)												335.8098	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	106.7070	49.1820	20.0336	2.9523	0.3047	0.0000	0.0000	0.0000	0.0000	4.3214	40.7112	111.5977	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												335.8098	
Space heating per m2											(98c) / (4) =	5.5051	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												287.6696	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	106.7070	49.1820	20.0336	2.9523	0.3047	0.0000	0.0000	0.0000	0.0000	4.3214	40.7112	111.5977	(98)
Space heating efficiency (main heating system 1)													
	287.6696	287.6696	287.6696	287.6696	287.6696	0.0000	0.0000	0.0000	0.0000	287.6696	287.6696	287.6696	(210)
Space heating fuel (main heating system)													
	37.0936	17.0967	6.9641	1.0263	0.1059	0.0000	0.0000	0.0000	0.0000	1.5022	14.1521	38.7937	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	206.7752	183.1478	195.6104	174.8321	171.3218	156.4093	156.0050	161.1708	161.7634	177.9023	186.0687	204.9254	(64)
Efficiency of water heater												463.5320	(216)
(217)m	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	(217)
Fuel for water heating, kWh/month													
	44.6086	39.5114	42.2000	37.7174	36.9601	33.7429	33.6557	34.7702	34.8980	38.3797	40.1415	44.2096	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.0252	15.3776	17.0252	16.4760	17.0252	16.4760	17.0252	17.0252	16.4760	17.0252	16.4760	17.0252	(231)
Lighting	21.8087	17.4957	15.7530	11.5413	8.9148	7.2835	8.1324	10.5708	13.7304	18.0151	20.3480	22.4148	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.1692	-21.4141	-32.9359	-39.7514	-45.4961	-43.5005	-43.0341	-39.3832	-33.2724	-25.5657	-16.0246	-12.0849	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.6757	-8.2143	-17.1107	-26.6952	-36.0303	-36.4170	-35.9274	-29.9854	-21.5298	-12.1994	-5.1129	-2.8677	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												116.7346	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												463.5320	
Water heating fuel used												460.7950	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	200.4577	(230a)
Total electricity for the above, kWh/year	200.4577	(231)
Electricity for lighting (calculated in Appendix L)	176.0085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-602.3977	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	351.5981	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	116.7346	0.1600	18.6726	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	460.7950	0.1405	64.7459	(264)
Space and water heating			83.4185	(265)
Pumps, fans and electric keep-hot	200.4577	0.1387	27.8060	(267)
Energy for lighting	176.0085	0.1443	25.4035	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-366.6321	0.1331	-48.7984	
PV Unit electricity exported	-235.7656	0.1249	-29.4428	
Total			-78.2412	(269)
Total CO2, kg/year			58.3867	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.9600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	116.7346	1.5920	185.8397	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	460.7950	1.5195	700.1927	(278)
Space and water heating			886.0324	(279)
Pumps, fans and electric keep-hot	200.4577	1.5128	303.2524	(281)
Energy for lighting	176.0085	1.5338	269.9678	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-366.6321	1.4918	-546.9513	
PV Unit electricity exported	-235.7656	0.4584	-108.0680	
Total			-655.0194	(283)
Total Primary energy kWh/year			804.2332	(286)
Dwelling Primary energy Rate (DPER)			13.1800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)

Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			12.9100	1.1450	14.7824			(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584			(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.4808			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 220.5820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100
E3 Sill	4.0300	0.0500	0.2015
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680
E18 Party wall between dwellings	10.4000	0.0600	0.6240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8251 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.3059 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	62.4925	62.2589	62.0298	60.9540	60.7527	59.8157	59.8157	59.6422	60.1766	60.7527	61.1599	61.5856	(39)
Average = Sum(39)m / 12 =												60.9530	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0206	1.0169	0.9992	0.9959	0.9806	0.9806	0.9777	0.9865	0.9959	1.0026	1.0096	(40)
HLP (average)												0.9992	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)
Hot water usage for baths	25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)
Hot water usage for other uses	35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)
Average daily hot water use (litres/day)												108.6142	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	238.0594	210.6611	223.9316	196.9806	191.0606	172.2672	169.9929	176.6154	178.4322	198.8617	211.3577	235.4530	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.5823	187.2445	199.4111	176.6767	172.1381	156.0751	154.8153	160.4756	161.6792	179.1117	188.9834	209.4662	(64)
									Total per year (kWh/year) = Sum(64)m =			2157.6593	(64)
12Total per year (kWh/year)												2158	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	102.9627	91.5488	98.2652	88.5360	87.3356	80.3188	80.3306	82.5326	82.3687	89.9294	93.3164	102.0961	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)													
	138.3907	136.2333	132.0769	122.9667	117.3866	111.5539	107.9712	110.9309	114.4009	120.8729	129.6061	137.2259	(72)
Total internal gains													
	458.6956	467.8621	449.6143	433.6928	412.8261	395.3615	381.0804	382.2194	393.2342	409.5174	433.5371	449.7889	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1200	10.6334	0.6300	0.7000	0.7700	6.8894	(74)
East	7.0400	19.6403	0.6300	0.7000	0.7700	42.2563	(76)
South	3.7500	46.7521	0.6300	0.7000	0.7700	53.5801	(78)

Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	561.4214	651.4408	719.8981	794.5043	836.2030	822.9592	790.3865	744.5158	695.2271	617.9227	558.2355	536.5800	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8094	60.0339	60.2555	61.3190	61.5222	62.4859	62.4859	62.6677	62.1111	61.5222	61.1126	60.6901	
alpha	4.9873	5.0023	5.0170	5.0879	5.1015	5.1657	5.1657	5.1778	5.1407	5.1015	5.0742	5.0460	
util living area													
	0.9785	0.9561	0.9115	0.8032	0.6430	0.4604	0.3322	0.3672	0.5795	0.8453	0.9559	0.9821	(86)
MIT	20.0175	20.2451	20.5158	20.8013	20.9454	20.9920	20.9988	20.9980	20.9753	20.7810	20.3681	19.9879	(87)
Th 2	20.0630	20.0662	20.0693	20.0840	20.0867	20.0995	20.0995	20.1019	20.0946	20.0867	20.0811	20.0753	(88)
util rest of house													
	0.9730	0.9457	0.8916	0.7658	0.5893	0.3976	0.2646	0.2962	0.5102	0.8057	0.9437	0.9775	(89)
MIT 2	18.9438	19.2286	19.5589	19.8962	20.0438	20.0951	20.0991	20.1012	20.0790	19.8853	19.3967	18.9160	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	19.3839	19.6452	19.9510	20.2671	20.4133	20.4627	20.4678	20.4687	20.4463	20.2524	19.7948	19.3553	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3839	19.6452	19.9510	20.2671	20.4133	20.4627	20.4678	20.4687	20.4463	20.2524	19.7948	19.3553	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9681	0.9402	0.8888	0.7737	0.6090	0.4231	0.2924	0.3253	0.5376	0.8135	0.9391	0.9730	(94)
Useful gains	543.4875	612.4549	639.8499	614.7442	509.2709	348.2133	231.0710	242.1751	373.7837	502.6594	524.2403	522.1061	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	942.6290	918.0173	834.3648	692.8727	529.3591	350.6808	231.3580	242.6686	381.9014	586.4094	776.4140	933.3471	(97)
Space heating kWh													
	296.9613	205.3379	144.7191	56.2525	14.9456	0.0000	0.0000	0.0000	0.0000	62.3100	181.5651	305.9633	(98a)
Space heating requirement - total per year (kWh/year)												1268.0548	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	296.9613	205.3379	144.7191	56.2525	14.9456	0.0000	0.0000	0.0000	0.0000	62.3100	181.5651	305.9633	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1268.0548	
Space heating per m2											(98c) / (4) =	20.7878	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	296.9613	205.3379	144.7191	56.2525	14.9456	0.0000	0.0000	0.0000	0.0000	62.3100	181.5651	305.9633	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	321.7349	222.4680	156.7921	60.9453	16.1924	0.0000	0.0000	0.0000	0.0000	67.5081	196.7119	331.4879	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.5823	187.2445	199.4111	176.6767	172.1381	156.0751	154.8153	160.4756	161.6792	179.1117	188.9834	209.4662	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.8199	84.2671	83.3526	81.8022	80.4514	79.8000	79.8000	79.8000	79.8000	81.9435	83.9701	84.9083	(217)
Fuel for water heating, kWh/month													
	249.4488	222.2036	239.2379	215.9803	213.9654	195.5828	194.0042	201.0973	202.6056	218.5795	225.0604	246.6968	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1373.8405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2624.4625	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3730.5260	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1373.8405	0.2100	288.5065	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2624.4625	0.2100	551.1371	(264)
Space and water heating			839.6436	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			807.7661	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.2400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1373.8405	1.1300	1552.4397	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2624.4625	1.1300	2965.6426	(278)
Space and water heating			4518.0824	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4333.8446	(286)
Target Primary Energy Rate (TPER)			71.0500	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 2	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	92 A	**DER**	2.03	**TER**	15.19
Environmental	99 A	**% DER < TER**			86.64
CO_2 Emissions (t/year)	0.09	**DFEE**	28.35	**TFEE**	32.55
Compliance Check	See BREL	**% DFEE < TFEE**			12.90
% DPER < TPER	70.35	**DPER**	24.25	**TPER**	81.79

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		130.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			16.3200	0.7752	12.6512			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1400	4.4534	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			58.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.0452			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9072.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.4460 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	10.3000	0.3000	3.0900	
E3 Sill	6.6300	0.0400	0.2652	
E4 Jamb	22.8600	0.0500	1.1430	
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4380 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 28.4832 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.2801	12.1193	11.9584	11.1540	10.9931	10.1887	10.1887	10.0279	10.5105	10.9931	11.3149	11.6366	(38)
Heat transfer coeff	40.7633	40.6024	40.4415	39.6372	39.4763	38.6719	38.6719	38.5110	38.9937	39.4763	39.7980	40.1198	(39)
Average = Sum(39)m / 12 =												39.5969	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8153	0.8120	0.8088	0.7927	0.7895	0.7734	0.7734	0.7702	0.7799	0.7895	0.7960	0.8024	(40)
HLP (average)												0.7919	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)
Hot water usage for mixer showers

59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 104.6166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7893	111.4018	108.4704	103.9553	100.3096	96.3818	94.8299	97.7482	100.8321	104.9611	109.5474	113.4859	(44)
Energy conte	180.2144	158.6347	166.7150	142.3097	135.0360	118.5126	114.6885	121.0327	124.3360	142.4312	156.0703	177.6915	(45)
Energy content (annual)										Total = Sum(45)m =		1737.6727	
Distribution loss (46)m = 0.15 x (45)m	27.0322	23.7952	25.0072	21.3465	20.2554	17.7769	17.2033	18.1549	18.6504	21.3647	23.4105	26.6537	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	238.6308	211.3979	225.1314	198.8417	193.4524	175.0446	173.1049	179.4491	180.8680	200.8476	212.6023	236.1079	(62)
WWHRS	-45.5909	-40.3210	-42.2218	-34.9613	-32.5827	-27.8812	-26.1342	-27.7911	-28.8470	-34.0074	-38.5263	-44.7466	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.0399	171.0770	182.9096	163.8804	160.8697	147.1634	146.9707	151.6580	152.0210	166.8401	174.0760	191.3613	(64)
										Total per year (kWh/year) = Sum(64)m =		2001.8670	(64)
12Total per year (kWh/year)												2002	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	106.6544	94.9566	102.1658	92.5436	91.6326	84.6310	84.8671	86.9765	86.5673	94.0915	97.1190	105.8156	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	143.3527	141.3045	137.3197	128.5327	123.1621	117.5431	114.0686	116.9039	120.2324	126.4671	134.8875	142.2252	(72)
Total internal gains	413.2008	420.6371	404.8455	390.3376	372.1451	359.2774	346.8311	348.1386	357.7926	369.7482	390.9904	405.5769	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	546.4341	656.7739	746.7378	836.2990	885.4124	873.1102	840.5715	792.1842	736.4247	636.3408	552.3831	518.3521	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8224	62.0673	62.3142	63.5788	63.8379	65.1657	65.1657	65.4379	64.6280	63.8379	63.3218	62.8140	
alpha	5.1215	5.1378	5.1543	5.2386	5.2559	5.3444	5.3444	5.3625	5.3085	5.2559	5.2215	5.1876	
util living area													
	0.9134	0.8351	0.7226	0.5598	0.4123	0.2832	0.2024	0.2236	0.3642	0.6207	0.8399	0.9264	(86)
Living	20.6837	20.7409	20.7849	20.8139	20.8215	20.8258	20.8260	20.8265	20.8242	20.8115	20.7554	20.6765	
Non living	19.8567	19.9266	19.9789	20.0239	20.0341	20.0530	20.0531	20.0566	20.0456	20.0250	19.9586	19.8589	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8382	20.7409	20.7849	20.8139	20.8215	20.8258	20.8260	20.8265	20.8242	20.8115	20.7554	20.7217	(87)
Th 2	20.2401	20.2429	20.2457	20.2596	20.2624	20.2764	20.2764	20.2792	20.2708	20.2624	20.2568	20.2513	(88)
util rest of house													
	0.8998	0.8142	0.6948	0.5285	0.3803	0.2513	0.1691	0.1886	0.3262	0.5824	0.8160	0.9143	(89)
MIT 2	20.0873	19.9266	19.9789	20.0239	20.0341	20.0530	20.0531	20.0566	20.0456	20.0250	19.9586	19.9296	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	20.4777	20.3501	20.3980	20.4347	20.4436	20.4549	20.4550	20.4570	20.4505	20.4340	20.3729	20.3415	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4777	20.3501	20.3980	20.4347	20.4436	20.4549	20.4550	20.4570	20.4505	20.4340	20.3729	20.3415	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9043	0.8173	0.7006	0.5360	0.3881	0.2592	0.1773	0.1972	0.3356	0.5915	0.8199	0.9159	(94)
Useful gains	494.1310	536.7653	523.1433	448.2335	343.6692	226.2953	149.0676	156.2176	247.1229	376.3997	452.9191	474.7575	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	659.4582	627.3100	562.0562	457.2042	345.1633	226.4189	149.0795	156.2384	247.6282	388.2088	528.2363	647.5931	(97)
Space heating kWh													
	123.0035	60.8460	28.9513	6.4589	1.1116	0.0000	0.0000	0.0000	0.0000	8.7859	54.2284	128.5897	(98a)
Space heating requirement - total per year (kWh/year)												411.9753	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	123.0035	60.8460	28.9513	6.4589	1.1116	0.0000	0.0000	0.0000	0.0000	8.7859	54.2284	128.5897	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												411.9753	
Space heating per m2											(98c) / (4) =	8.2395	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 283.7031 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	123.0035	60.8460	28.9513	6.4589	1.1116	0.0000	0.0000	0.0000	0.0000	8.7859	54.2284	128.5897	(98)
Space heating efficiency (main heating system 1)													
	283.7031	283.7031	283.7031	283.7031	283.7031	0.0000	0.0000	0.0000	0.0000	283.7031	283.7031	283.7031	(210)
Space heating fuel (main heating system)													
	43.3564	21.4471	10.2048	2.2766	0.3918	0.0000	0.0000	0.0000	0.0000	3.0969	19.1145	45.3254	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.0399	171.0770	182.9096	163.8804	160.8697	147.1634	146.9707	151.6580	152.0210	166.8401	174.0760	191.3613	(64)
Efficiency of water heater												463.5487	(216)
(217)m	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	(217)
Fuel for water heating, kWh/month													
	41.6439	36.9059	39.4585	35.3534	34.7039	31.7471	31.7056	32.7167	32.7950	35.9919	37.5529	41.2818	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.9551	12.6046	13.9551	13.5049	13.9551	13.5049	13.9551	13.9551	13.5049	13.9551	13.5049	13.9551	(231)
Lighting	16.8480	13.5161	12.1697	8.9161	6.8870	5.6267	6.2826	8.1663	10.6072	13.9173	15.7195	17.3162	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0271	-13.7549	-24.3099	-32.6041	-39.4052	-38.3986	-37.6875	-33.1582	-25.7753	-17.4018	-9.4642	-6.5946	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.5676	-4.2439	-11.1164	-20.9639	-31.4474	-33.0254	-32.0580	-24.7786	-15.2935	-6.9538	-2.3207	-1.1549	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 145.2135 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 463.5487

Water heating fuel used 431.8569 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	164.3096	(230a)
Total electricity for the above, kWh/year	164.3096	(231)
Electricity for lighting (calculated in Appendix L)	135.9727	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-471.5055	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	405.8472	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	145.2135	0.1593	23.1327	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	431.8569	0.1405	60.6551	(264)
Space and water heating			83.7878	(265)
Pumps, fans and electric keep-hot	164.3096	0.1387	22.7918	(267)
Energy for lighting	135.9727	0.1443	19.6251	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.5814	0.1312	-37.6126	
PV Unit electricity exported	-184.9242	0.1208	-22.3392	
Total			-59.9518	(269)
Total CO2, kg/year			66.2529	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.3300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	145.2135	1.5896	230.8292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	431.8569	1.5193	656.1278	(278)
Space and water heating			886.9570	(279)
Pumps, fans and electric keep-hot	164.3096	1.5128	248.5676	(281)
Energy for lighting	135.9727	1.5338	208.5594	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.5814	1.4849	-425.5366	
PV Unit electricity exported	-184.9242	0.4432	-81.9551	
Total			-507.4918	(283)
Total Primary energy kWh/year			836.5922	(286)
Dwelling Primary energy Rate (DPER)			16.7300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		130.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)

Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			10.1500	1.1450	11.6221			(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
Total net area of external elements Aum(A, m2)			58.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.2781			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	191.4460	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9293	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	28.2074	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	55.3444	55.1236	54.9071	53.8904	53.7002	52.8147	52.8147	52.6507	53.1558	53.7002	54.0850	54.4873	(39)
Average = Sum(39)m / 12 =												53.8895	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1069	1.1025	1.0981	1.0778	1.0740	1.0563	1.0563	1.0530	1.0631	1.0740	1.0817	1.0897	(40)
HLP (average)												1.0778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6901	(42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day)	98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	220.7358	195.4180	207.9166	183.3084	178.0887	160.8829	158.9709	164.9801	166.4765	185.1667	196.3539	218.3706	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7090	174.1685	185.6654	164.8835	160.9173	146.1892	145.1979	150.3339	151.2738	167.2444	176.0502	194.7887	(64)
										Total per year (kWh/year) = Sum(64)m =		2013.4219	(64)
12Total per year (kWh/year)												2013	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	97.2026	86.4804	92.9402	83.9900	83.0224	76.5335	76.6658	78.6638	78.3934	85.3759	88.3276	96.4162	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

130.6487	128.6911	124.9197	116.6528	111.5893	106.2965	103.0454	105.7310	108.8797	114.7525	122.6772	129.5916	(72)

Total internal gains

403.9092	411.4804	395.8579	381.8838	363.9848	348.4570	336.2203	337.3781	346.8660	361.4461	382.2064	396.3558	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7800	19.6403	0.6300	0.7000	0.7700	34.6934	(76)
South	3.7000	46.7521	0.6300	0.7000	0.7700	52.8657	(78)
West	0.6700	19.6403	0.6300	0.7000	0.7700	4.0216	(80)

Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	495.4899	573.7955	630.8703	688.4363	716.8061	701.6682	675.6194	642.6149	607.1345	544.6968	493.1433	473.8740	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0441	48.2366	48.4267	49.3404	49.5151	50.3453	50.3453	50.5021	50.0223	49.5151	49.1628	48.7999	
alpha	4.2029	4.2158	4.2284	4.2894	4.3010	4.3564	4.3564	4.3668	4.3348	4.3010	4.2775	4.2533	
util living area	0.9649	0.9373	0.8897	0.7883	0.6443	0.4712	0.3418	0.3736	0.5752	0.8214	0.9365	0.9697	(86)
MIT	19.8147	20.0702	20.3748	20.7075	20.8995	20.9801	20.9961	20.9942	20.9530	20.7027	20.2252	19.7842	(87)
Th 2	19.9952	19.9988	20.0024	20.0190	20.0221	20.0367	20.0367	20.0394	20.0311	20.0221	20.0158	20.0092	(88)
util rest of house	0.9571	0.9244	0.8678	0.7508	0.5900	0.4042	0.2680	0.2971	0.5042	0.7803	0.9211	0.9630	(89)
MIT 2	18.6507	18.9686	19.3401	19.7365	19.9396	20.0247	20.0352	20.0370	19.9996	19.7441	19.1782	18.6230	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	19.2559	19.5414	19.8782	20.2414	20.4388	20.5215	20.5348	20.5348	20.4954	20.2425	19.7227	19.2268	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2559	19.5414	19.8782	20.2414	20.4388	20.5215	20.5348	20.5348	20.4954	20.2425	19.7227	19.2268	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9501	0.9175	0.8648	0.7598	0.6138	0.4383	0.3063	0.3368	0.5390	0.7903	0.9158	0.9564	(94)
Useful gains	470.7650	526.4395	545.5851	523.0812	439.9669	307.5422	206.9698	216.4206	327.2664	430.4552	451.6213	453.2057	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	827.7272	807.0871	734.5560	611.1939	469.2740	312.7402	207.8176	217.6991	339.9511	517.8063	682.6971	818.7702	(97)
Space heating kWh	265.5799	188.5952	140.5944	63.4411	21.8045	0.0000	0.0000	0.0000	0.0000	64.9892	166.3746	271.9800	(98a)
Space heating requirement - total per year (kWh/year)												1183.3589	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	265.5799	188.5952	140.5944	63.4411	21.8045	0.0000	0.0000	0.0000	0.0000	64.9892	166.3746	271.9800	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1183.3589	
Space heating per m2										(98c) / (4) =		23.6672	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	265.5799	188.5952	140.5944	63.4411	21.8045	0.0000	0.0000	0.0000	0.0000	64.9892	166.3746	271.9800	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	287.7355	204.3285	152.3233	68.7336	23.6235	0.0000	0.0000	0.0000	0.0000	70.4108	180.2542	294.6696	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7090	174.1685	185.6654	164.8835	160.9173	146.1892	145.1979	150.3339	151.2738	167.2444	176.0502	194.7887	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.7336	84.2386	83.4444	82.1124	80.7770	79.8000	79.8000	79.8000	79.8000	82.1294	83.9332	84.8085	(217)
Fuel for water heating, kWh/month	232.1498	206.7561	222.5018	200.8023	199.2119	183.1945	181.9523	188.3884	189.5662	203.6353	209.7504	229.6807	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1282.0790	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2447.5897	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3528.9959	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1282.0790	0.2100	269.2366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2447.5897	0.2100	513.9938	(264)
Space and water heating			783.2304	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			759.7203	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.1900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1282.0790	1.1300	1448.7493	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2447.5897	1.1300	2765.7763	(278)
Space and water heating			4214.5256	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4089.3332	(286)
Target Primary Energy Rate (TPER)			81.7900	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 3	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	87 B	**DER**	4.13	**TER**	17.52
Environmental	98 A	**% DER < TER**			76.43
CO_2 Emissions (t/year)	0.16	**DFEE**	27.86	**TFEE**	34.69
Compliance Check	See BREL	**% DFEE < TFEE**			19.69
% DPER < TPER	50.74	**DPER**	46.64	**TPER**	94.68

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000 (1b)	x	2.6000 (2b)	=	101.4000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	101.4000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			7.6400	0.7752	5.9225			(27)
EXTERNAL	36.0400	9.9800	26.0600	0.1400	3.6484	70.0000	1824.2000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		12.5115			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			39.0000			40.0000	1560.0000	(32d)
Party Ceiling 1			39.0000			30.0000	1170.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8958.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		229.6974 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	5.8000	0.3000	1.7400	
E3 Sill	4.8000	0.0400	0.1920	
E4 Jamb	13.3400	0.0500	0.6670	
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	2.6000	0.0600	0.1560	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6058 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.1173 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.5785	9.4530	9.3275	8.7001	8.5746	7.9472	7.9472	7.8217	8.1982	8.5746	8.8256	9.0766	(38)
Heat transfer coeff	27.6958	27.5703	27.4448	26.8174	26.6919	26.0645	26.0645	25.9390	26.3155	26.6919	26.9429	27.1938	(39)
Average = Sum(39)m / 12 =												26.7860	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7101	0.7069	0.7037	0.6876	0.6844	0.6683	0.6683	0.6651	0.6748	0.6844	0.6908	0.6973	(40)
HLP (average)												0.6868	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3800 (42)
Hot water usage for mixer showers

53.2775	52.4768	51.3101	49.0778	47.4304	45.5933	44.5491	45.7069	46.9762	48.9487	51.2290	53.0734	(42a)

Hot water usage for baths

20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)

Hot water usage for other uses

28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)

Average daily hot water use (litres/day) 94.2642 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.5289	100.3780	97.7369	93.6686	90.3837	86.8447	85.4461	88.0754	90.8539	94.5742	98.7067	102.2555	(44)
Energy conte	162.3807	142.9370	150.2179	128.2276	121.6738	106.7856	103.3396	109.0557	112.0319	128.3364	140.6259	160.1074	(45)
Energy content (annual)										Total = Sum(45)m =		1565.7195	
Distribution loss (46)m = 0.15 x (45)m	24.3571	21.4405	22.5327	19.2341	18.2511	16.0178	15.5009	16.3584	16.8048	19.2505	21.0939	24.0161	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

220.7971	195.7002	208.6343	184.7596	180.0902	163.3176	161.7560	167.4721	168.5639	186.7528	197.1579	218.5238	(62)
WWHRS -41.0809	-36.3323	-38.0450	-31.5028	-29.3595	-25.1231	-23.5489	-25.0419	-25.9933	-30.6433	-34.7151	-40.3201	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
179.7162	159.3679	170.5893	153.2568	150.7308	138.1945	138.2071	142.4302	142.5706	156.1095	162.4427	178.2037	(64)
								Total per year (kWh/year) = Sum(64)m =			1871.8193	(64)
12Total per year (kWh/year)											1872	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month												
100.7247	89.7371	96.6806	87.8613	87.1897	80.7318	81.0936	82.9942	82.4762	89.4050	91.9837	99.9688	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.8268	68.4511	61.8268	63.8877	61.8268	63.8877	61.8268	61.8268	63.8877	61.8268	63.8877	61.8268	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	135.3827	133.5373	129.9470	122.0296	117.1904	112.1275	108.9967	111.5513	114.5503	120.1680	127.7551	134.3667	(72)
Total internal gains	359.9366	365.9507	352.6236	340.1410	324.8767	314.0134	303.5699	304.8894	313.0618	323.2446	341.2570	353.6689	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains 41.4903	81.1639	133.6653	194.9429	238.9099	244.5668	232.8375	200.0040	155.4583	96.3078	51.7336	34.1196	(83)
Total gains 401.4269	447.1146	486.2890	535.0839	563.7865	558.5802	536.4075	504.8934	468.5201	419.5524	392.9905	387.7885	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	89.8472	90.2562	90.6688	92.7901	93.2263	95.4704	95.4704	95.9323	94.5599	93.2263	92.3579	91.5056	
alpha	6.9898	7.0171	7.0446	7.1860	7.2151	7.3647	7.3647	7.3955	7.3040	7.2151	7.1572	7.1004	
util living area	0.9276	0.8721	0.7731	0.5998	0.4396	0.2986	0.2138	0.2363	0.3873	0.6499	0.8553	0.9358	(86)
Living	20.7941	20.8237	20.8499	20.8673	20.8704	20.8733	20.8733	20.8738	20.8722	20.8667	20.8387	20.7929	
Non living	20.0813	20.1184	20.1502	20.1826	20.1885	20.2063	20.2063	20.2098	20.1992	20.1853	20.1504	20.0912	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8947	20.8237	20.8499	20.8673	20.8704	20.8733	20.8733	20.8738	20.8722	20.8667	20.8387	20.8219	(87)
Th 2	20.3319	20.3347	20.3376	20.3518	20.3546	20.3689	20.3689	20.3718	20.3632	20.3546	20.3489	20.3432	(88)
util rest of house	0.9143	0.8526	0.7462	0.5694	0.4094	0.2692	0.1831	0.2040	0.3517	0.6129	0.8314	0.9237	(89)
MIT 2	20.2320	20.1184	20.1502	20.1826	20.1885	20.2063	20.2063	20.2098	20.1992	20.1853	20.1504	20.1366	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	20.7248	20.6429	20.6705	20.6917	20.6955	20.7023	20.7023	20.7036	20.6996	20.6920	20.6622	20.6462	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7248	20.6429	20.6705	20.6917	20.6955	20.7023	20.7023	20.7036	20.6996	20.6920	20.6622	20.6462	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9224	0.8619	0.7600	0.5854	0.4254	0.2847	0.1993	0.2211	0.3705	0.6324	0.8432	0.9295	(94)
Useful gains	370.2637	385.3652	369.5677	313.2303	239.8161	159.0413	106.9229	111.6288	173.5938	265.3257	331.3749	360.4568	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	454.8967	434.0352	388.9064	316.2236	240.1079	159.0522	106.9234	111.6300	173.6716	269.3746	365.4045	447.2348	(97)
Space heating kWh	62.9670	32.7062	14.3880	2.1552	0.2171	0.0000	0.0000	0.0000	0.0000	3.0124	24.5013	64.5629	(98a)
Space heating requirement - total per year (kWh/year)												204.5101	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	62.9670	32.7062	14.3880	2.1552	0.2171	0.0000	0.0000	0.0000	0.0000	3.0124	24.5013	64.5629	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												204.5101	
Space heating per m2										(98c) / (4) =		5.2438	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 190.8327 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	62.9670	32.7062	14.3880	2.1552	0.2171	0.0000	0.0000	0.0000	0.0000	3.0124	24.5013	64.5629	(98)
Space heating efficiency (main heating system 1)	190.8327	190.8327	190.8327	190.8327	190.8327	0.0000	0.0000	0.0000	0.0000	190.8327	190.8327	190.8327	(210)
Space heating fuel (main heating system)	32.9959	17.1387	7.5396	1.1294	0.1138	0.0000	0.0000	0.0000	0.0000	1.5785	12.8391	33.8322	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	179.7162	159.3679	170.5893	153.2568	150.7308	138.1945	138.2071	142.4302	142.5706	156.1095	162.4427	178.2037	(64)
Efficiency of water heater												264.7084	(216)
(217)m	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	(217)
Fuel for water heating, kWh/month	67.8922	60.2051	64.4442	57.8965	56.9422	52.2063	52.2111	53.8065	53.8595	58.9741	61.3667	67.3208	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	10.8849	9.8316	10.8849	10.5338	10.8849	10.5338	10.8849	10.8849	10.5338	10.8849	10.5338	10.8849	(231)
Lighting	13.4326	10.7761	9.7027	7.1086	5.4909	4.4861	5.0090	6.5109	8.4570	11.0960	12.5329	13.8059	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-6.3106	-10.9175	-19.5069	-26.4848	-32.3577	-31.6764	-31.0884	-27.2126	-20.9416	-13.9297	-7.4744	-5.1762	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.1175	-3.0171	-7.9199	-14.9872	-22.4960	-23.6196	-22.9081	-17.6417	-10.8536	-4.9263	-1.6494	-0.8234	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												107.1672	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												264.7084	
Water heating fuel used												707.1251	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)

mechanical ventilation fans (SFP = 1.0360)	128.1615	(230a)
Total electricity for the above, kWh/year	128.1615	(231)
Electricity for lighting (calculated in Appendix L)	108.4087	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-365.0365	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	685.8260	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	107.1672	0.1597	17.1186	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	707.1251	0.1404	99.2723	(264)
Space and water heating			116.3909	(265)
Pumps, fans and electric keep-hot	128.1615	0.1387	17.7776	(267)
Energy for lighting	108.4087	0.1443	15.6467	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-233.0768	0.1310	-30.5400	
PV Unit electricity exported	-131.9598	0.1208	-15.9399	
Total			-46.4799	(269)
Total CO2, kg/year			103.3354	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.6500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	107.1672	1.5912	170.5249	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	707.1251	1.5191	1074.1800	(278)
Space and water heating			1244.7049	(279)
Pumps, fans and electric keep-hot	128.1615	1.5128	193.8827	(281)
Energy for lighting	108.4087	1.5338	166.2809	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-233.0768	1.4841	-345.8997	
PV Unit electricity exported	-131.9598	0.4432	-58.4781	
Total			-404.3778	(283)
Total Primary energy kWh/year			1200.4907	(286)
Dwelling Primary energy Rate (DPER)			30.7800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000	(1b)	x 2.6000	(2b) =	101.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 39.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	101.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1972	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4472	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4472	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate												
	0.5702	0.5590	0.5479	0.4920	0.4808	0.4249	0.4249	0.4137	0.4472	0.4808	0.5031	0.5255 (22b)
Effective ac	0.6626	0.6563	0.6501	0.6210	0.6156	0.5903	0.5903	0.5856	0.6000	0.6156	0.6266	0.6381 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			7.4100	1.1450	8.4847			(27)
EXTERNAL	36.0400	9.7500	26.2900	0.1800	4.7322			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.0365			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	239.6974	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900
E3 Sill	4.8000	0.0500	0.2400
E4 Jamb	13.3400	0.0500	0.6670
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	2.6000	0.0600	0.1560
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2038	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	21.2403	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.1713	21.9600	21.7530	20.7804	20.5984	19.7513	19.7513	19.5944	20.0776	20.5984	20.9665	21.3514	(38)
Heat transfer coeff	43.4116	43.2004	42.9933	42.0207	41.8387	40.9916	40.9916	40.8347	41.3179	41.8387	42.2068	42.5917	(39)
Average = Sum(39)m / 12 =												42.0198	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1131	1.1077	1.1024	1.0775	1.0728	1.0511	1.0511	1.0470	1.0594	1.0728	1.0822	1.0921	(40)
HLP (average)												1.0774	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.3800	(42)

Hot water usage for mixer showers													
	47.3578	46.6461	45.6090	43.6247	42.1604	40.5274	39.5992	40.6284	41.7566	43.5100	45.5369	47.1763	(42a)
Hot water usage for baths													
	20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)
Hot water usage for other uses													
	28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)
Average daily hot water use (litres/day)												88.8064	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	96.6092	94.5473	92.0358	88.2155	85.1137	81.7787	80.4962	82.9968	85.6343	89.1355	93.0146	96.3584	(44)
Energy conte	153.0053	134.6340	141.4555	120.7626	114.5793	100.5565	97.3532	102.7674	105.5956	120.9560	132.5164	150.8740	(45)
Energy content (annual)										Total = Sum(45)m =		1475.0560	
Distribution loss (46)m = 0.15 x (45)m													
	22.9508	20.1951	21.2183	18.1144	17.1869	15.0835	14.6030	15.4151	15.8393	18.1434	19.8775	22.6311	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	203.9314	180.6318	192.3816	170.0459	165.5054	149.8398	148.2792	153.6935	154.8789	171.8821	181.7997	201.8001	(62)
WWHRS	-21.6500	-19.1474	-20.0501	-16.6023	-15.4727	-13.2401	-12.4105	-13.1973	-13.6987	-16.1493	-18.2952	-21.2491	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	182.2814	161.4843	172.3315	153.4436	150.0327	136.5997	135.8688	140.4962	141.1802	155.7328	163.5045	180.5510	(64)
										Total per year (kWh/year) = Sum(64)m =		1873.5067	(64)
12Total per year (kWh/year)												1874	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	91.6151	81.5640	87.7748	79.5802	78.8385	72.8617	73.1108	74.9110	74.5372	80.9587	83.4883	90.9065	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	60.8308	67.3484	60.8308	62.8585	60.8308	62.8585	60.8308	60.8308	62.8585	60.8308	62.8585	60.8308	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)												
	123.1386	121.3750	117.9769	110.5281	105.9657	101.1968	98.2672	100.6869	103.5239	108.8155	115.9560	122.1861 (72)
Total internal gains												
	349.6965	355.6856	342.6575	330.6102	315.6559	302.0534	291.8444	293.0289	301.0061	313.8962	331.4286	343.4923 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.7100	19.6403	0.6300	0.7000	0.7700	40.2756	(76)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	44.4772	87.0068	143.2878	208.9768	256.1089	262.1730	249.5994	214.4022	166.6497	103.2409	55.4578	36.5759 (83)
Total gains	394.1737	442.6925	485.9453	539.5870	571.7648	564.2264	541.4438	507.4311	467.6558	417.1371	386.8865	380.0681 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8163	60.1088	60.3983	61.7963	62.0651	63.3476	63.3476	63.5910	62.8474	62.0651	61.5237	60.9678	
alpha	4.9878	5.0073	5.0266	5.1198	5.1377	5.2232	5.2232	5.2394	5.1898	5.1377	5.1016	5.0645	
util living area													
	0.9776	0.9595	0.9189	0.8108	0.6473	0.4604	0.3324	0.3689	0.5905	0.8542	0.9558	0.9806	(86)
MIT	20.0283	20.2245	20.4929	20.7956	20.9452	20.9925	20.9989	20.9981	20.9741	20.7728	20.3758	20.0151	(87)
Th 2	20.4434	20.4461	20.4488	20.4613	20.4636	20.4745	20.4745	20.4765	20.4703	20.4636	20.4589	20.4540	(88)
util rest of house													
	0.9744	0.9539	0.9083	0.7898	0.6162	0.4239	0.2930	0.3274	0.5500	0.8325	0.9489	0.9778	(89)
MIT 2	19.5372	19.7322	19.9949	20.2894	20.4222	20.4698	20.4739	20.4755	20.4529	20.2751	19.8928	19.5328	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	19.9024	20.0983	20.3652	20.6658	20.8111	20.8585	20.8643	20.8641	20.8405	20.6452	20.2520	19.8915	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9024	20.0983	20.3652	20.6658	20.8111	20.8585	20.8643	20.8641	20.8405	20.6452	20.2520	19.8915	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9708	0.9501	0.9066	0.7980	0.6365	0.4506	0.3222	0.3582	0.5785	0.8402	0.9460	0.9744	(94)
Useful gains	382.6506	420.5833	440.5360	430.5647	363.9369	254.2472	174.4768	181.7434	270.5337	350.4764	365.9909	370.3495	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	677.3235	656.5700	596.1111	494.4055	381.1977	256.5444	174.7997	182.2913	278.5032	420.2777	555.1025	668.3257	(97)
Space heating kWh													
	219.2366	158.5831	115.7479	45.9654	12.8421	0.0000	0.0000	0.0000	0.0000	51.9322	136.1603	221.6943	(98a)
Space heating requirement - total per year (kWh/year)												962.1618	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	219.2366	158.5831	115.7479	45.9654	12.8421	0.0000	0.0000	0.0000	0.0000	51.9322	136.1603	221.6943	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												962.1618	
Space heating per m2											(98c) / (4) =	24.6708	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	219.2366	158.5831	115.7479	45.9654	12.8421	0.0000	0.0000	0.0000	0.0000	51.9322	136.1603	221.6943	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	237.5261	171.8126	125.4040	49.8000	13.9134	0.0000	0.0000	0.0000	0.0000	56.2645	147.5193	240.1889	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	182.2814	161.4843	172.3315	153.4436	150.0327	136.5997	135.8688	140.4962	141.1802	155.7328	163.5045	180.5510	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.4748	84.0191	83.1876	81.7089	80.4428	79.8000	79.8000	79.8000	79.8000	81.8752	83.6523	84.5213	(217)
Fuel for water heating, kWh/month													
	215.7819	192.1995	207.1602	187.7931	186.5085	171.1775	170.2616	176.0604	176.9175	190.2076	195.4572	213.6161	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	12.6394	10.1398	9.1298	6.6889	5.1667	4.2212	4.7132	6.1264	7.9576	10.4408	11.7929	12.9907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.5051	-11.4259	-17.7250	-21.5712	-24.7560	-23.6831	-23.4153	-21.3606	-18.0067	-13.7752	-8.5514	-6.3952	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0121	-4.3759	-8.9665	-13.8670	-18.7247	-18.9396	-18.6975	-15.6360	-11.2211	-6.3662	-2.7219	-1.5795	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1042.4288	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2283.1411	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	102.0075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-321.2788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3192.2985	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1042.4288	0.2100	218.9101	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2283.1411	0.2100	479.4596	(264)
Space and water heating			698.3697	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	102.0075	0.1443	14.7228	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	0.1330	-26.3533	
PV Unit electricity exported	-123.1080	0.1251	-15.3980	
Total			-41.7513	(269)
Total CO2, kg/year			683.2705	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.5200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1042.4288	1.1300	1177.9446	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2283.1411	1.1300	2579.9494	(278)
Space and water heating			3757.8940	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	102.0075	1.5338	156.4624	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	1.4914	-295.5498	
PV Unit electricity exported	-123.1080	0.4591	-56.5166	
Total			-352.0664	(283)
Total Primary energy kWh/year			3692.3908	(286)
Target Primary Energy Rate (TPER)			94.6800	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 4	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	93 A	**DER**	1.40	**TER**	11.92
Environmental	99 A	**% DER < TER**			88.26
CO_2 Emissions (t/year)	0.1	**DFEE**	26.03	**TFEE**	31.13
Compliance Check	See BREL	**% DFEE < TFEE**			16.40
% DPER < TPER	72.29	**DPER**	17.62	**TPER**	63.58

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	87.0000 (1b)	x	2.6000 (2b)	=	226.2000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.2000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			25.5000	0.7752	19.7674			(27)
EXTERNAL	86.2100	27.8400	58.3700	0.1400	8.1718	70.0000	4085.9000	(29a)
External Roof 1	6.3100		6.3100	0.1000	0.6310	9.0000	56.7900	(30)
Total net area of external elements Aum(A, m2)			92.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4422			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			87.0000			40.0000	3480.0000	(32d)
Party Ceiling 1			80.6900			30.0000	2420.7000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13871.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.4482 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.2600	0.3000	3.6780		
E3 Sill	4.8000	0.0400	0.1920		
E4 Jamb	27.9200	0.0500	1.3960		
E7 Party floor between dwellings (in blocks of flats)	58.6100	0.0700	4.1027		
E16 Corner (normal)	10.4000	0.0900	0.9360		
E18 Party wall between dwellings	5.2000	0.0600	0.3120		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000		
E14 Flat roof	7.7100	0.0400	0.3084		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.9251	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	41.3673	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.3674	21.0875	20.8076	19.4080	19.1280	17.7284	17.7284	17.4485	18.2883	19.1280	19.6879	20.2477	(38)
Heat transfer coeff	62.7348	62.4548	62.1749	60.7753	60.4954	59.0958	59.0958	58.8158	59.6556	60.4954	61.0552	61.6151	(39)
Average = Sum(39)m / 12 =												60.7053	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7211	0.7179	0.7147	0.6986	0.6953	0.6793	0.6793	0.6760	0.6857	0.6953	0.7018	0.7082	(40)
HLP (average)												0.6978	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5824	(42)
Hot water usage for mixer showers	75.9577	74.8162	73.1528	69.9702	67.6216	65.0023	63.5136	65.1644	66.9740	69.7862	73.0371	75.6667	(42a)
Hot water usage for baths	29.1581	28.7251	28.1153	26.9909	26.1490	25.2154	24.7112	25.3167	25.9760	26.9750	28.1225	29.0596	(42b)
Hot water usage for other uses	41.0763	39.5826	38.0889	36.5952	35.1015	33.6079	33.6079	35.1015	36.5952	38.0889	39.5826	41.0763	(42c)
Average daily hot water use (litres/day)												134.4067	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1921	143.1239	139.3570	133.5564	128.8721	123.8256	121.8326	125.5826	129.5452	134.8501	140.7422	145.8025	(44)
Energy conte	231.5326	203.8065	214.1865	182.8320	173.4866	152.2581	147.3460	155.4975	159.7422	182.9903	200.5131	228.2915	(45)
Energy content (annual)										Total = Sum(45)m =		2232.4829	
Distribution loss (46)m = 0.15 x (45)m	34.7299	30.5710	32.1280	27.4248	26.0230	22.8387	22.1019	23.3246	23.9613	27.4485	30.0770	34.2437	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	289.9490	256.5697	272.6029	239.3640	231.9030	208.7901	205.7624	213.9139	216.2742	241.4067	257.0451	286.7079	(62)
WWHRS	-58.5690	-51.7989	-54.2408	-44.9135	-41.8578	-35.8180	-33.5737	-35.7022	-37.0587	-43.6881	-49.4933	-57.4844	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	231.3800	204.7708	218.3621	194.4505	190.0452	172.9721	172.1887	178.2117	179.2155	197.7186	207.5518	229.2235	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2376.0905	(64)
Electric shower(s)												2376	(64)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	123.7177	109.9762	117.9501	106.0172	104.4174	95.8514	95.7257	98.4360	98.3399	107.5774	111.8962	122.6400	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.7482	130.3641	117.7482	121.6731	117.7482	121.6731	117.7482	117.7482	121.6731	117.7482	121.6731	117.7482	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.4490	235.8715	229.7669	216.7711	200.3661	184.9478	174.6474	172.2249	178.3295	191.3253	207.7303	223.1486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	(71)
Water heating gains (Table 5)	166.2872	163.6551	158.5351	147.2462	140.3460	133.1270	128.6635	132.3065	136.5832	144.5933	155.4114	164.8388	(72)
Total internal gains	579.2203	591.6265	567.7861	547.4262	520.1962	501.4838	482.7950	484.0155	498.3217	515.4027	546.5507	567.4714	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	10.3800	19.6403	0.5700	0.7000	0.7700	56.3704	(76)
South	9.9000	46.7521	0.5700	0.7000	0.7700	127.9800	(78)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains	201.4914	352.8046	504.1560	653.9998	754.5250	757.4660	726.8775	651.4412	556.4242	396.0935	243.1846	171.1882	(83)

Total gains	780.7117	944.4311	1071.9422	1201.4260	1274.7211	1258.9498	1209.6725	1135.4567	1054.7458	911.4962	789.7353	738.6596	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4226	61.6979	61.9756	63.4029	63.6963	65.2048	65.2048	65.5152	64.5929	63.6963	63.1122	62.5388	
alpha	5.0948	5.1132	5.1317	5.2269	5.2464	5.3470	5.3470	5.3677	5.3062	5.2464	5.2075	5.1693	
util living area													
	0.9317	0.8615	0.7570	0.5929	0.4380	0.3001	0.2149	0.2382	0.3886	0.6563	0.8675	0.9428	(86)
Living	20.6623	20.7251	20.7751	20.8109	20.8207	20.8258	20.8260	20.8267	20.8239	20.8077	20.7417	20.6554	
Non living	19.9105	19.9886	20.0494	20.1030	20.1157	20.1358	20.1360	20.1397	20.1280	20.1033	20.0237	19.9130	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8273	20.7251	20.7751	20.8109	20.8207	20.8258	20.8260	20.8267	20.8239	20.8077	20.7417	20.7036	(87)
Th 2	20.3222	20.3251	20.3279	20.3421	20.3449	20.3592	20.3592	20.3620	20.3535	20.3449	20.3393	20.3336	(88)
util rest of house													
	0.9216	0.8446	0.7330	0.5643	0.4080	0.2702	0.1836	0.2052	0.3528	0.6219	0.8485	0.9341	(89)
MIT 2	20.1581	19.9886	20.0494	20.1030	20.1157	20.1358	20.1360	20.1397	20.1280	20.1033	20.0237	19.9888	(90)
Living area fraction										fLA = Living area / (4) =		0.3333	(91)
MIT	20.3811	20.2341	20.2913	20.3389	20.3507	20.3658	20.3660	20.3687	20.3600	20.3381	20.2630	20.2270	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3811	20.2341	20.2913	20.3389	20.3507	20.3658	20.3660	20.3687	20.3600	20.3381	20.2630	20.2270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9225	0.8422	0.7317	0.5642	0.4083	0.2705	0.1840	0.2055	0.3531	0.6215	0.8462	0.9326	(94)
Useful gains	720.2067	795.3941	784.2925	677.8431	520.4266	340.5076	222.5329	233.3826	372.4633	566.5307	668.2354	688.8579	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1008.8463	957.6907	857.4708	695.2043	523.3267	340.7370	222.5542	233.4206	373.4413	589.1102	803.6727	987.5071	(97)
Space heating kWh													
	214.7479	109.0633	54.4446	12.5001	2.1577	0.0000	0.0000	0.0000	0.0000	16.7992	97.5149	222.1950	(98a)
Space heating requirement - total per year (kWh/year)												729.4226	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	214.7479	109.0633	54.4446	12.5001	2.1577	0.0000	0.0000	0.0000	0.0000	16.7992	97.5149	222.1950	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												729.4226	
Space heating per m2											(98c) / (4) =	8.3842	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												328.9724	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	214.7479	109.0633	54.4446	12.5001	2.1577	0.0000	0.0000	0.0000	0.0000	16.7992	97.5149	222.1950	(98)
Space heating efficiency (main heating system 1)													
	328.9724	328.9724	328.9724	328.9724	328.9724	0.0000	0.0000	0.0000	0.0000	328.9724	328.9724	328.9724	(210)
Space heating fuel (main heating system)													
	65.2784	33.1527	16.5499	3.7997	0.6559	0.0000	0.0000	0.0000	0.0000	5.1066	29.6423	67.5421	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	231.3800	204.7708	218.3621	194.4505	190.0452	172.9721	172.1887	178.2117	179.2155	197.7186	207.5518	229.2235	(64)
Efficiency of water heater												463.3353	(216)
(217)m	463.3353	463.3353	463.3353	463.3353	463.3353	463.3353	463.3353	463.3353	463.3353	463.3353	463.3353	463.3353	(217)
Fuel for water heating, kWh/month													
	49.9379	44.1950	47.1283	41.9675	41.0168	37.3319	37.1629	38.4628	38.6794	42.6729	44.7952	49.4725	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	24.2818	21.9320	24.2818	23.4985	24.2818	23.4985	24.2818	24.2818	23.4985	24.2818	23.4985	24.2818	(231)
Lighting	30.8382	24.7396	22.2753	16.3198	12.6059	10.2991	11.4995	14.9475	19.4153	25.4740	28.7728	31.6953	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.6854	-23.3136	-40.8979	-54.3418	-65.1655	-63.2808	-62.1156	-54.9012	-43.0085	-29.3379	-16.0925	-11.2540	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.8730	-7.7490	-20.2411	-38.1062	-57.1124	-59.9832	-58.2517	-45.0865	-27.8683	-12.6951	-4.2460	-2.1202	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												221.7276	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												463.3353	
Water heating fuel used												512.8231	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	285.8987	(230a)
Total electricity for the above, kWh/year	285.8987	(231)
Electricity for lighting (calculated in Appendix L)	248.8823	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-813.7273	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	455.6044	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	221.7276	0.1591	35.2867	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	512.8231	0.1406	72.1005	(264)
Space and water heating			107.3872	(265)
Pumps, fans and electric keep-hot	285.8987	0.1387	39.6577	(267)
Energy for lighting	248.8823	0.1443	35.9214	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-477.3947	0.1314	-62.7298	
PV Unit electricity exported	-336.3326	0.1208	-40.6385	
Total			-103.3683	(269)
Total CO2, kg/year			79.5981	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.9100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	221.7276	1.5890	352.3279	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	512.8231	1.5199	779.4168	(278)
Space and water heating			1131.7447	(279)
Pumps, fans and electric keep-hot	285.8987	1.5128	432.5076	(281)
Energy for lighting	248.8823	1.5338	381.7440	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-477.3947	1.4855	-709.1475	
PV Unit electricity exported	-336.3326	0.4433	-149.0891	
Total			-858.2366	(283)
Total Primary energy kWh/year			1087.7596	(286)
Dwelling Primary energy Rate (DPER)			12.5000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	87.0000	(1b) x	2.6000	(2b) =	226.2000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		226.2000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1326	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3826	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4878	0.4783	0.4687	0.4209	0.4113	0.3635	0.3635	0.3539	0.3826	0.4113	0.4305	0.4496	(22b)
Effective ac	0.6190	0.6144	0.6098	0.5886	0.5846	0.5661	0.5661	0.5626	0.5732	0.5846	0.5926	0.6011	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			19.4200	1.1450	22.2366			(27)
EXTERNAL	86.2100	21.7600	64.4500	0.1800	11.6010			(29a)
External Roof 1	6.3100		6.3100	0.1100	0.6941			(30)
Total net area of external elements Aum(A, m2)			92.5200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.8717			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 168.7229 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.2600	0.0500	0.6130
E3 Sill	4.8000	0.0500	0.2400
E4 Jamb	27.9200	0.0500	1.3960
E7 Party floor between dwellings (in blocks of flats)	58.6100	0.0700	4.1027
E16 Corner (normal)	10.4000	0.0900	0.9360
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000
E14 Flat roof	7.7100	0.0800	0.6168

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.2165 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 45.0882 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.2057	45.8608	45.5227	43.9347	43.6376	42.2544	42.2544	41.9983	42.7872	43.6376	44.2386	44.8670	(38)
Heat transfer coeff													
	91.2940	90.9490	90.6109	89.0229	88.7258	87.3427	87.3427	87.0865	87.8754	88.7258	89.3269	89.9552	(39)
Average = Sum(39)m / 12 =												89.0215	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0494	1.0454	1.0415	1.0233	1.0198	1.0039	1.0039	1.0010	1.0101	1.0198	1.0267	1.0340	(40)
HLP (average)												1.0232	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5824 (42)

Hot water usage for mixer showers

67.5179	66.5033	65.0247	62.1958	60.1080	57.7799	56.4565	57.9239	59.5324	62.0322	64.9219	67.2593	(42a)

Hot water usage for baths

29.1581	28.7251	28.1153	26.9909	26.1490	25.2154	24.7112	25.3167	25.9760	26.9750	28.1225	29.0596	(42b)

Hot water usage for other uses

41.0763	39.5826	38.0889	36.5952	35.1015	33.6079	33.6079	35.1015	36.5952	38.0889	39.5826	41.0763	(42c)

Average daily hot water use (litres/day) 126.6255 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.7524	134.8110	131.2289	125.7819	121.3586	116.6032	114.7755	118.3421	122.1037	127.0961	132.6270	137.3951	(44)
Energy conte	218.1661	191.9690	201.6940	172.1891	163.3720	143.3772	138.8111	146.5323	150.5660	172.4682	188.9515	215.1275	(45)
Energy content (annual)										Total = Sum(45)m =		2103.2239	
Distribution loss (46)m = 0.15 x (45)m													
	32.7249	28.7954	30.2541	25.8284	24.5058	21.5066	20.8217	21.9798	22.5849	25.8702	28.3427	32.2691	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	269.0921	237.9668	252.6200	221.4724	214.2980	192.6605	189.7371	197.4584	199.8493	223.3942	238.2348	266.0536	(62)
WWHRS	-30.8664	-27.2985	-28.5854	-23.6698	-22.0594	-18.8764	-17.6936	-18.8154	-19.5303	-23.0240	-26.0834	-30.2948	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.2258	210.6683	224.0346	197.8026	192.2386	173.7841	172.0435	178.6430	180.3191	200.3702	212.1513	235.7588	(64)
										Total per year (kWh/year) = Sum(64)m =		2416.0398	(64)
12Total per year (kWh/year)												2416	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	113.2811	100.6279	107.8041	96.6795	95.0620	87.0995	86.8955	89.4628	89.4898	98.0865	102.2530	112.2708	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	129.1195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	117.7455	130.3611	117.7455	121.6704	117.7455	121.6704	117.7455	117.7455	121.6704	117.7455	121.6704	117.7455	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	233.4490	235.8715	229.7669	216.7711	200.3661	184.9478	174.6474	172.2249	178.3295	191.3253	207.7303	223.1486	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	35.9120	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	-103.2956	(71)
Water heating gains (Table 5)													
	152.2595	149.7439	144.8980	134.2771	127.7716	120.9716	116.7951	120.2458	124.2914	131.8367	142.0181	150.9016	(72)
Total internal gains													
	568.1899	580.7124	557.1463	537.4544	510.6191	489.3257	470.9239	471.9521	486.0272	505.6435	536.1546	556.5316	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.4300	10.6334	0.6300	0.7000	0.7700	11.1465	(74)
East	7.9000	19.6403	0.6300	0.7000	0.7700	47.4183	(76)
South	7.5400	46.7521	0.6300	0.7000	0.7700	107.7318	(78)
West	0.5500	19.6403	0.6300	0.7000	0.7700	3.3013	(80)

Solar gains	169.5979	296.9567	424.3442	550.4632	635.0749	637.5518	611.8050	548.3096	468.3362	333.3913	204.6909	144.0918	(83)
Total gains	737.7878	877.6691	981.4905	1087.9176	1145.6940	1126.8775	1082.7289	1020.2617	954.3634	839.0348	740.8455	700.6234	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6631	44.8325	44.9997	45.8025	45.9559	46.6836	46.6836	46.8209	46.4006	45.9559	45.6466	45.3278	
alpha	3.9775	3.9888	4.0000	4.0535	4.0637	4.1122	4.1122	4.1214	4.0934	4.0637	4.0431	4.0219	
util living area													
	0.9704	0.9436	0.8973	0.7981	0.6547	0.4817	0.3517	0.3875	0.5952	0.8387	0.9460	0.9751	(86)
MIT	19.6251	19.9173	20.2621	20.6425	20.8714	20.9721	20.9939	20.9910	20.9342	20.6248	20.0752	19.5866	(87)
Th 2	20.0424	20.0457	20.0489	20.0640	20.0668	20.0801	20.0801	20.0825	20.0750	20.0668	20.0611	20.0551	(88)
util rest of house													
	0.9644	0.9328	0.8783	0.7643	0.6040	0.4174	0.2796	0.3125	0.5276	0.8030	0.9338	0.9700	(89)
MIT 2	18.4591	18.8253	19.2497	19.7074	19.9560	20.0619	20.0774	20.0784	20.0276	19.7014	19.0386	18.4197	(90)
Living area fraction										fLA = Living area / (4) =		0.3333	(91)
MIT	18.8478	19.1893	19.5871	20.0191	20.2611	20.3653	20.3829	20.3826	20.3298	20.0092	19.3842	18.8087	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8478	19.1893	19.5871	20.0191	20.2611	20.3653	20.3829	20.3826	20.3298	20.0092	19.3842	18.8087	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9547	0.9210	0.8678	0.7625	0.6149	0.4377	0.3036	0.3373	0.5469	0.8005	0.9230	0.9611	(94)
Useful gains	704.3510	808.3573	851.7058	829.5746	704.5415	493.2405	328.6660	344.1379	521.9480	671.6473	683.8144	673.4000	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1328.1246	1299.5982	1185.8378	989.8538	759.5945	503.5544	330.4128	346.8305	547.4457	834.8388	1097.3060	1314.1261	(97)
Space heating kWh													
	464.0875	330.1139	248.5942	115.4010	40.9594	0.0000	0.0000	0.0000	0.0000	121.4144	297.7139	476.7002	(98a)
Space heating requirement - total per year (kWh/year)												2094.9846	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	464.0875	330.1139	248.5942	115.4010	40.9594	0.0000	0.0000	0.0000	0.0000	121.4144	297.7139	476.7002	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2094.9846	
Space heating per m2											(98c) / (4) =	24.0803	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	464.0875	330.1139	248.5942	115.4010	40.9594	0.0000	0.0000	0.0000	0.0000	121.4144	297.7139	476.7002	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	502.8034	357.6532	269.3328	125.0282	44.3764	0.0000	0.0000	0.0000	0.0000	131.5432	322.5503	516.4683	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.2258	210.6683	224.0346	197.8026	192.2386	173.7841	172.0435	178.6430	180.3191	200.3702	212.1513	235.7588	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5281	85.0627	84.2936	82.8956	81.2463	79.8000	79.8000	79.8000	79.8000	82.9730	84.8196	85.6052	(217)
Fuel for water heating, kWh/month													
	278.5352	247.6623	265.7789	238.6165	236.6121	217.7745	215.5934	223.8634	225.9637	241.4884	250.1206	275.4025	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.4652	19.6269	17.6718	12.9471	10.0007	8.1707	9.1230	11.8584	15.4029	20.2095	22.8266	25.1452	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233a)m	-16.3457	-24.6685	-37.9243	-45.6973	-51.9963	-49.5274	-48.9147	-44.8091	-38.0827	-29.5029	-18.5342	-13.9483	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.8852	-10.5816	-21.6184	-33.3571	-44.9992	-45.5540	-45.0292	-37.7217	-27.1178	-15.4279	-6.6140	-3.8415	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2269.7558	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2917.4116	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	197.4482	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-716.6988	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4753.9168	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2269.7558	0.2100	476.6487	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2917.4116	0.2100	612.6564	(264)
Space and water heating			1089.3052	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	197.4482	0.1443	28.4979	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-419.9513	0.1332	-55.9341	
PV Unit electricity exported	-296.7476	0.1251	-37.1258	
Total			-93.0599	(269)
Total CO2, kg/year			1036.6724	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2269.7558	1.1300	2564.8241	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2917.4116	1.1300	3296.6751	(278)
Space and water heating			5861.4992	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	197.4482	1.5338	302.8526	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-419.9513	1.4922	-626.6407	
PV Unit electricity exported	-296.7476	0.4592	-136.2658	
Total			-762.9065	(283)
Total Primary energy kWh/year			5531.5461	(286)
Target Primary Energy Rate (TPER)			63.5800	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 5	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	93 A	**DER**	1.67	**TER**	13.24
Environmental	99 A	**% DER < TER**			87.39
CO_2 Emissions (t/year)	0.09	**DFEE**	23.99	**TFEE**	29.08
Compliance Check	See BREL	**% DFEE < TFEE**			17.52
% DPER < TPER	71.16	**DPER**	20.49	**TPER**	71.05

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000 (1b)	x	2.6000 (2b)	=	158.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000	(23c)
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			15.6000	0.7752	12.0930			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1400	5.3466	70.0000	2673.3000	(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.3116			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			61.0000			30.0000	1830.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12845.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	210.5820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.3000	2.4600

E3 Sill	4.0300	0.0400	0.1612	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.8348 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 27.1464 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.9818	14.7855	14.5892	13.6079	13.4116	12.4303	12.4303	12.2340	12.8228	13.4116	13.8041	14.1967	(38)
Heat transfer coeff	42.1282	41.9319	41.7356	40.7543	40.5580	39.5767	39.5767	39.3804	39.9692	40.5580	40.9506	41.3431	(39)

Average = Sum(39)m / 12 = 40.7052

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6906	0.6874	0.6842	0.6681	0.6649	0.6488	0.6488	0.6456	0.6552	0.6649	0.6713	0.6778	(40)
HLP (average)												0.6673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 115.2889 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.3976	122.7662	119.5355	114.5599	110.5421	106.2135	104.5036	107.7199	111.1185	115.6688	120.7229	125.0633	(44)
Energy conte	198.5991	174.8175	183.7216	156.8267	148.8109	130.6019	126.3880	133.3797	137.0202	156.9614	171.9919	195.8189	(45)

Energy content (annual) Total = Sum(45)m = 1914.9379

Distribution loss (46)m = 0.15 x (45)m

29.7899	26.2226	27.5582	23.5240	22.3216	19.5903	18.9582	20.0070	20.5530	23.5442	25.7988	29.3728	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.1340 (55)

Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

257.0155	227.5807	242.1380	213.3587	207.2273	187.1339	184.8044	191.7961	193.5522	215.3778	228.5239	254.2353	(62)
WWHRS -50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

206.7752	183.1478	195.6104	174.8321	171.3218	156.4093	156.0050	161.1708	161.7634	177.9023	186.0687	204.9254	(64)

Total per year (kWh/year) = Sum(64)m = 2135.9322 (64)

12Total per year (kWh/year) 2136 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

112.7673	100.3374	107.8206	97.3705	96.2127	88.6507	88.7571	91.0819	90.7848	98.9228	102.4129	111.8429	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	151.5690	149.3116	144.9201	135.2368	129.3182	123.1260	119.2972	122.4219	126.0900	132.9607	142.2402	150.3265	(72)
Total internal gains	468.6716	477.7165	459.2553	442.7540	421.5555	406.7247	392.2042	393.5081	404.7143	418.4030	442.9623	459.6873	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	580.9741	678.4143	754.7528	837.2340	884.4441	874.2292	839.7096	789.6139	734.8828	646.2452	579.2866	554.5688	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	84.6985	85.0950	85.4951	87.5538	87.9775	90.1590	90.1590	90.6083	89.2735	87.9775	87.1342	86.3069	
alpha	6.6466	6.6730	6.6997	6.8369	6.8652	7.0106	7.0106	7.0406	6.9516	6.8652	6.8089	6.7538	
util living area													
	0.9365	0.8675	0.7575	0.5824	0.4258	0.2897	0.2074	0.2294	0.3750	0.6401	0.8642	0.9466	(86)
Living	20.7712	20.8122	20.8423	20.8605	20.8638	20.8669	20.8669	20.8675	20.8657	20.8596	20.8248	20.7675	
Non living	20.0704	20.1213	20.1577	20.1913	20.1974	20.2155	20.2155	20.2191	20.2083	20.1937	20.1509	20.0772	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8830	20.8122	20.8423	20.8605	20.8638	20.8669	20.8669	20.8675	20.8657	20.8596	20.8248	20.8001	(87)
Th 2	20.3491	20.3520	20.3548	20.3691	20.3720	20.3863	20.3863	20.3892	20.3805	20.3720	20.3662	20.3605	(88)
util rest of house													
	0.9252	0.8488	0.7316	0.5537	0.3972	0.2619	0.1785	0.1989	0.3415	0.6048	0.8423	0.9368	(89)
MIT 2	20.2380	20.1213	20.1577	20.1913	20.1974	20.2155	20.2155	20.2191	20.2083	20.1937	20.1509	20.1283	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	20.5023	20.4045	20.4382	20.4656	20.4705	20.4825	20.4825	20.4849	20.4777	20.4666	20.4271	20.4036	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5023	20.4045	20.4382	20.4656	20.4705	20.4825	20.4825	20.4849	20.4777	20.4666	20.4271	20.4036	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9280	0.8504	0.7351	0.5581	0.4017	0.2663	0.1830	0.2037	0.3467	0.6102	0.8445	0.9375	(94)
Useful gains	539.1518	576.9448	554.7945	467.2461	355.3045	232.7939	153.6561	160.8618	254.8074	394.3630	489.2088	519.9100	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	682.5751	650.1323	581.7214	471.3464	355.7141	232.8099	153.6570	160.8635	254.9133	400.1714	545.7521	669.9068	(97)
Space heating kWh													
	106.7070	49.1820	20.0336	2.9523	0.3047	0.0000	0.0000	0.0000	0.0000	4.3214	40.7112	111.5977	(98a)
Space heating requirement - total per year (kWh/year)												335.8098	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	106.7070	49.1820	20.0336	2.9523	0.3047	0.0000	0.0000	0.0000	0.0000	4.3214	40.7112	111.5977	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												335.8098	
Space heating per m2											(98c) / (4) =	5.5051	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												287.6696	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement													
	106.7070	49.1820	20.0336	2.9523	0.3047	0.0000	0.0000	0.0000	0.0000	4.3214	40.7112	111.5977	(98)
Space heating efficiency (main heating system 1)													
	287.6696	287.6696	287.6696	287.6696	287.6696	0.0000	0.0000	0.0000	0.0000	287.6696	287.6696	287.6696	(210)
Space heating fuel (main heating system)													
	37.0936	17.0967	6.9641	1.0263	0.1059	0.0000	0.0000	0.0000	0.0000	1.5022	14.1521	38.7937	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	206.7752	183.1478	195.6104	174.8321	171.3218	156.4093	156.0050	161.1708	161.7634	177.9023	186.0687	204.9254	(64)
Efficiency of water heater												463.5320	(216)
(217)m	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	463.5320	(217)
Fuel for water heating, kWh/month													
	44.6086	39.5114	42.2000	37.7174	36.9601	33.7429	33.6557	34.7702	34.8980	38.3797	40.1415	44.2096	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.0252	15.3776	17.0252	16.4760	17.0252	16.4760	17.0252	17.0252	16.4760	17.0252	16.4760	17.0252	(231)
Lighting	21.8087	17.4957	15.7530	11.5413	8.9148	7.2835	8.1324	10.5708	13.7304	18.0151	20.3480	22.4148	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.6448	-16.4985	-29.1165	-39.0209	-47.1131	-45.8803	-45.0305	-39.6715	-30.9077	-20.8940	-11.3673	-7.9268	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9616	-5.2743	-13.7379	-25.7791	-38.5957	-40.5197	-39.3391	-30.4133	-18.7723	-8.5684	-2.8887	-1.4476	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												116.7346	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												463.5320	
Water heating fuel used												460.7950	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	200.4577	(230a)
Total electricity for the above, kWh/year	200.4577	(231)
Electricity for lighting (calculated in Appendix L)	176.0085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-570.3696	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	383.6262	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	116.7346	0.1600	18.6726	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	460.7950	0.1405	64.7459	(264)
Space and water heating			83.4185	(265)
Pumps, fans and electric keep-hot	200.4577	0.1387	27.8060	(267)
Energy for lighting	176.0085	0.1443	25.4035	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-343.0721	0.1313	-45.0337	
PV Unit electricity exported	-227.2975	0.1209	-27.4772	
Total			-72.5109	(269)
Total CO2, kg/year			64.1169	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.0500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	116.7346	1.5920	185.8397	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	460.7950	1.5195	700.1927	(278)
Space and water heating			886.0324	(279)
Pumps, fans and electric keep-hot	200.4577	1.5128	303.2524	(281)
Energy for lighting	176.0085	1.5338	269.9678	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-343.0721	1.4849	-509.4442	
PV Unit electricity exported	-227.2975	0.4435	-100.8054	
Total			-610.2496	(283)
Total Primary energy kWh/year			849.0030	(286)
Dwelling Primary energy Rate (DPER)			13.9200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000	(1b)	x 2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)

Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			12.9100	1.1450	14.7824			(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584			(29a)
Total net area of external elements Aum(A, m2)			56.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.4808			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 220.5820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100
E3 Sill	4.0300	0.0500	0.2015
E4 Jamb	26.6600	0.0500	1.3330
E7 Party floor between dwellings (in blocks of flats)	43.1800	0.0700	3.0226
E16 Corner (normal)	7.8000	0.0900	0.7020
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680
E18 Party wall between dwellings	10.4000	0.0600	0.6240
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	29.2200	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8251 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.3059 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff	62.4925	62.2589	62.0298	60.9540	60.7527	59.8157	59.8157	59.6422	60.1766	60.7527	61.1599	61.5856	(39)
Average = Sum(39)m / 12 =												60.9530	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0206	1.0169	0.9992	0.9959	0.9806	0.9806	0.9777	0.9865	0.9959	1.0026	1.0096	(40)
HLP (average)												0.9992	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)
Hot water usage for baths	25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)
Hot water usage for other uses	35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)
Average daily hot water use (litres/day)												108.6142	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	238.0594	210.6611	223.9316	196.9806	191.0606	172.2672	169.9929	176.6154	178.4322	198.8617	211.3577	235.4530	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	211.5823	187.2445	199.4111	176.6767	172.1381	156.0751	154.8153	160.4756	161.6792	179.1117	188.9834	209.4662	(64)
									Total per year (kWh/year) = Sum(64)m =			2157.6593	(64)
12Total per year (kWh/year)												2158	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	102.9627	91.5488	98.2652	88.5360	87.3356	80.3188	80.3306	82.5326	82.3687	89.9294	93.3164	102.0961	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)													
	138.3907	136.2333	132.0769	122.9667	117.3866	111.5539	107.9712	110.9309	114.4009	120.8729	129.6061	137.2259	(72)
Total internal gains													
	458.6956	467.8621	449.6143	433.6928	412.8261	395.3615	381.0804	382.2194	393.2342	409.5174	433.5371	449.7889	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1200	10.6334	0.6300	0.7000	0.7700	6.8894	(74)
East	7.0400	19.6403	0.6300	0.7000	0.7700	42.2563	(76)
South	3.7500	46.7521	0.6300	0.7000	0.7700	53.5801	(78)

Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	561.4214	651.4408	719.8981	794.5043	836.2030	822.9592	790.3865	744.5158	695.2271	617.9227	558.2355	536.5800	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8094	60.0339	60.2555	61.3190	61.5222	62.4859	62.4859	62.6677	62.1111	61.5222	61.1126	60.6901	
alpha	4.9873	5.0023	5.0170	5.0879	5.1015	5.1657	5.1657	5.1778	5.1407	5.1015	5.0742	5.0460	
util living area													
	0.9785	0.9561	0.9115	0.8032	0.6430	0.4604	0.3322	0.3672	0.5795	0.8453	0.9559	0.9821	(86)
MIT	20.0175	20.2451	20.5158	20.8013	20.9454	20.9920	20.9988	20.9980	20.9753	20.7810	20.3681	19.9879	(87)
Th 2	20.0630	20.0662	20.0693	20.0840	20.0867	20.0995	20.0995	20.1019	20.0946	20.0867	20.0811	20.0753	(88)
util rest of house													
	0.9730	0.9457	0.8916	0.7658	0.5893	0.3976	0.2646	0.2962	0.5102	0.8057	0.9437	0.9775	(89)
MIT 2	18.9438	19.2286	19.5589	19.8962	20.0438	20.0951	20.0991	20.1012	20.0790	19.8853	19.3967	18.9160	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	19.3839	19.6452	19.9510	20.2671	20.4133	20.4627	20.4678	20.4687	20.4463	20.2524	19.7948	19.3553	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3839	19.6452	19.9510	20.2671	20.4133	20.4627	20.4678	20.4687	20.4463	20.2524	19.7948	19.3553	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9681	0.9402	0.8888	0.7737	0.6090	0.4231	0.2924	0.3253	0.5376	0.8135	0.9391	0.9730	(94)
Useful gains	543.4875	612.4549	639.8499	614.7442	509.2709	348.2133	231.0710	242.1751	373.7837	502.6594	524.2403	522.1061	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	942.6290	918.0173	834.3648	692.8727	529.3591	350.6808	231.3580	242.6686	381.9014	586.4094	776.4140	933.3471	(97)
Space heating kWh													
	296.9613	205.3379	144.7191	56.2525	14.9456	0.0000	0.0000	0.0000	0.0000	62.3100	181.5651	305.9633	(98a)
Space heating requirement - total per year (kWh/year)												1268.0548	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	296.9613	205.3379	144.7191	56.2525	14.9456	0.0000	0.0000	0.0000	0.0000	62.3100	181.5651	305.9633	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1268.0548	
Space heating per m2											(98c) / (4) =	20.7878	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	296.9613	205.3379	144.7191	56.2525	14.9456	0.0000	0.0000	0.0000	0.0000	62.3100	181.5651	305.9633	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	321.7349	222.4680	156.7921	60.9453	16.1924	0.0000	0.0000	0.0000	0.0000	67.5081	196.7119	331.4879	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.5823	187.2445	199.4111	176.6767	172.1381	156.0751	154.8153	160.4756	161.6792	179.1117	188.9834	209.4662	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.8199	84.2671	83.3526	81.8022	80.4514	79.8000	79.8000	79.8000	79.8000	81.9435	83.9701	84.9083	(217)
Fuel for water heating, kWh/month													
	249.4488	222.2036	239.2379	215.9803	213.9654	195.5828	194.0042	201.0973	202.6056	218.5795	225.0604	246.6968	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1373.8405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2624.4625	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3730.5260	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1373.8405	0.2100	288.5065	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2624.4625	0.2100	551.1371	(264)
Space and water heating			839.6436	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			807.7661	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.2400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1373.8405	1.1300	1552.4397	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2624.4625	1.1300	2965.6426	(278)
Space and water heating			4518.0824	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4333.8446	(286)
Target Primary Energy Rate (TPER)			71.0500	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 6	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	92 A	**DER**	2.05	**TER**	15.19
Environmental	99 A	**% DER < TER**			86.50
CO_2 Emissions (t/year)	0.09	**DFEE**	28.35	**TFEE**	32.55
Compliance Check	See BREL	**% DFEE < TFEE**			12.90
% DPER < TPER	70.16	**DPER**	24.40	**TPER**	81.79

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000	(23c)
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			16.3200	0.7752	12.6512			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1400	4.4534	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			58.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.0452			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			50.0000			30.0000	1500.0000	(32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9072.3000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							181.4460	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	10.3000	0.3000	3.0900	
E3 Sill	6.6300	0.0400	0.2652	
E4 Jamb	22.8600	0.0500	1.1430	
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.4380 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 28.4832 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.2801	12.1193	11.9584	11.1540	10.9931	10.1887	10.1887	10.0279	10.5105	10.9931	11.3149	11.6366	(38)
Heat transfer coeff	40.7633	40.6024	40.4415	39.6372	39.4763	38.6719	38.6719	38.5110	38.9937	39.4763	39.7980	40.1198	(39)
Average = Sum(39)m / 12 =												39.5969	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8153	0.8120	0.8088	0.7927	0.7895	0.7734	0.7734	0.7702	0.7799	0.7895	0.7960	0.8024	(40)
HLP (average)												0.7919	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)
Hot water usage for mixer showers

59.1265	58.2380	56.9432	54.4658	52.6376	50.5987	49.4399	50.7249	52.1335	54.3226	56.8531	58.9000	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 104.6166 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7893	111.4018	108.4704	103.9553	100.3096	96.3818	94.8299	97.7482	100.8321	104.9611	109.5474	113.4859	(44)
Energy conte	180.2144	158.6347	166.7150	142.3097	135.0360	118.5126	114.6885	121.0327	124.3360	142.4312	156.0703	177.6915	(45)
Energy content (annual)										Total = Sum(45)m =		1737.6727	
Distribution loss (46)m = 0.15 x (45)m	27.0322	23.7952	25.0072	21.3465	20.2554	17.7769	17.2033	18.1549	18.6504	21.3647	23.4105	26.6537	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	238.6308	211.3979	225.1314	198.8417	193.4524	175.0446	173.1049	179.4491	180.8680	200.8476	212.6023	236.1079	(62)
WWHRS	-45.5909	-40.3210	-42.2218	-34.9613	-32.5827	-27.8812	-26.1342	-27.7911	-28.8470	-34.0074	-38.5263	-44.7466	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.0399	171.0770	182.9096	163.8804	160.8697	147.1634	146.9707	151.6580	152.0210	166.8401	174.0760	191.3613	(64)
										Total per year (kWh/year) = Sum(64)m =		2001.8670	(64)
12Total per year (kWh/year)												2002	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	106.6544	94.9566	102.1658	92.5436	91.6326	84.6310	84.8671	86.9765	86.5673	94.0915	97.1190	105.8156	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	143.3527	141.3045	137.3197	128.5327	123.1621	117.5431	114.0686	116.9039	120.2324	126.4671	134.8875	142.2252	(72)
Total internal gains	413.2008	420.6371	404.8455	390.3376	372.1451	359.2774	346.8311	348.1386	357.7926	369.7482	390.9904	405.5769	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	546.4341	656.7739	746.7378	836.2990	885.4124	873.1102	840.5715	792.1842	736.4247	636.3408	552.3831	518.3521	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8224	62.0673	62.3142	63.5788	63.8379	65.1657	65.1657	65.4379	64.6280	63.8379	63.3218	62.8140	
alpha	5.1215	5.1378	5.1543	5.2386	5.2559	5.3444	5.3444	5.3625	5.3085	5.2559	5.2215	5.1876	
util living area													
	0.9134	0.8351	0.7226	0.5598	0.4123	0.2832	0.2024	0.2236	0.3642	0.6207	0.8399	0.9264	(86)
Living	20.6837	20.7409	20.7849	20.8139	20.8215	20.8258	20.8260	20.8265	20.8242	20.8115	20.7554	20.6765	
Non living	19.8567	19.9266	19.9789	20.0239	20.0341	20.0530	20.0531	20.0566	20.0456	20.0250	19.9586	19.8589	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8382	20.7409	20.7849	20.8139	20.8215	20.8258	20.8260	20.8265	20.8242	20.8115	20.7554	20.7217	(87)
Th 2	20.2401	20.2429	20.2457	20.2596	20.2624	20.2764	20.2764	20.2792	20.2708	20.2624	20.2568	20.2513	(88)
util rest of house													
	0.8998	0.8142	0.6948	0.5285	0.3803	0.2513	0.1691	0.1886	0.3262	0.5824	0.8160	0.9143	(89)
MIT 2	20.0873	19.9266	19.9789	20.0239	20.0341	20.0530	20.0531	20.0566	20.0456	20.0250	19.9586	19.9296	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	20.4777	20.3501	20.3980	20.4347	20.4436	20.4549	20.4550	20.4570	20.4505	20.4340	20.3729	20.3415	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4777	20.3501	20.3980	20.4347	20.4436	20.4549	20.4550	20.4570	20.4505	20.4340	20.3729	20.3415	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9043	0.8173	0.7006	0.5360	0.3881	0.2592	0.1773	0.1972	0.3356	0.5915	0.8199	0.9159	(94)
Useful gains	494.1310	536.7653	523.1433	448.2335	343.6692	226.2953	149.0676	156.2176	247.1229	376.3997	452.9191	474.7575	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	659.4582	627.3100	562.0562	457.2042	345.1633	226.4189	149.0795	156.2384	247.6282	388.2088	528.2363	647.5931	(97)
Space heating kWh													
	123.0035	60.8460	28.9513	6.4589	1.1116	0.0000	0.0000	0.0000	0.0000	8.7859	54.2284	128.5897	(98a)
Space heating requirement - total per year (kWh/year)												411.9753	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	123.0035	60.8460	28.9513	6.4589	1.1116	0.0000	0.0000	0.0000	0.0000	8.7859	54.2284	128.5897	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												411.9753	
Space heating per m2											(98c) / (4) =	8.2395	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 283.7031 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	123.0035	60.8460	28.9513	6.4589	1.1116	0.0000	0.0000	0.0000	0.0000	8.7859	54.2284	128.5897	(98)
Space heating efficiency (main heating system 1)													
	283.7031	283.7031	283.7031	283.7031	283.7031	0.0000	0.0000	0.0000	0.0000	283.7031	283.7031	283.7031	(210)
Space heating fuel (main heating system)													
	43.3564	21.4471	10.2048	2.2766	0.3918	0.0000	0.0000	0.0000	0.0000	3.0969	19.1145	45.3254	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.0399	171.0770	182.9096	163.8804	160.8697	147.1634	146.9707	151.6580	152.0210	166.8401	174.0760	191.3613	(64)
Efficiency of water heater												463.5487	(216)
(217)m	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	463.5487	(217)
Fuel for water heating, kWh/month													
	41.6439	36.9059	39.4585	35.3534	34.7039	31.7471	31.7056	32.7167	32.7950	35.9919	37.5529	41.2818	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.9551	12.6046	13.9551	13.5049	13.9551	13.5049	13.9551	13.9551	13.5049	13.9551	13.5049	13.9551	(231)
Lighting	17.4563	14.0041	12.6091	9.2380	7.1357	5.8299	6.5094	8.4612	10.9902	14.4198	16.2871	17.9414	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0286	-13.7587	-24.3180	-32.6161	-39.4191	-38.4115	-37.7016	-33.1727	-25.7875	-17.4087	-9.4667	-6.5957	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.5661	-4.2402	-11.1083	-20.9519	-31.4335	-33.0125	-32.0439	-24.7640	-15.2813	-6.9469	-2.3182	-1.1538	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 145.2135 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 463.5487

Water heating fuel used 431.8569 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)

mechanical ventilation fans (SFP = 1.0360)	164.3096	(230a)
Total electricity for the above, kWh/year	164.3096	(231)
Electricity for lighting (calculated in Appendix L)	140.8820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-471.5055	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	410.7565	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	145.2135	0.1593	23.1327	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	431.8569	0.1405	60.6551	(264)
Space and water heating			83.7878	(265)
Pumps, fans and electric keep-hot	164.3096	0.1387	22.7918	(267)
Energy for lighting	140.8820	0.1443	20.3336	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.6849	0.1312	-37.6260	
PV Unit electricity exported	-184.8206	0.1208	-22.3262	
Total			-59.9522	(269)
Total CO2, kg/year			66.9611	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.3400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	145.2135	1.5896	230.8292	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	431.8569	1.5193	656.1278	(278)
Space and water heating			886.9570	(279)
Pumps, fans and electric keep-hot	164.3096	1.5128	248.5676	(281)
Energy for lighting	140.8820	1.5338	216.0894	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-286.6849	1.4849	-425.6895	
PV Unit electricity exported	-184.8206	0.4432	-81.9074	
Total			-507.5969	(283)
Total Primary energy kWh/year			844.0171	(286)
Dwelling Primary energy Rate (DPER)			16.8800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)

Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			10.1500	1.1450	11.6221			(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
Total net area of external elements Aum(A, m2)			58.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.2781			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	191.4460	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	45.1400	0.0700	3.1598
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9293	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	28.2074	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff	55.3444	55.1236	54.9071	53.8904	53.7002	52.8147	52.8147	52.6507	53.1558	53.7002	54.0850	54.4873	(39)
Average = Sum(39)m / 12 =												53.8895	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1069	1.1025	1.0981	1.0778	1.0740	1.0563	1.0563	1.0530	1.0631	1.0740	1.0817	1.0897	(40)
HLP (average)												1.0778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6901	(42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day)	98.5597	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	220.7358	195.4180	207.9166	183.3084	178.0887	160.8829	158.9709	164.9801	166.4765	185.1667	196.3539	218.3706	(62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	196.7090	174.1685	185.6654	164.8835	160.9173	146.1892	145.1979	150.3339	151.2738	167.2444	176.0502	194.7887	(64)
										Total per year (kWh/year) = Sum(64)m =		2013.4219	(64)
12Total per year (kWh/year)												2013	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	97.2026	86.4804	92.9402	83.9900	83.0224	76.5335	76.6658	78.6638	78.3934	85.3759	88.3276	96.4162	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

130.6487	128.6911	124.9197	116.6528	111.5893	106.2965	103.0454	105.7310	108.8797	114.7525	122.6772	129.5916	(72)

Total internal gains

403.9092	411.4804	395.8579	381.8838	363.9848	348.4570	336.2203	337.3781	346.8660	361.4461	382.2064	396.3558	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7800	19.6403	0.6300	0.7000	0.7700	34.6934	(76)
South	3.7000	46.7521	0.6300	0.7000	0.7700	52.8657	(78)
West	0.6700	19.6403	0.6300	0.7000	0.7700	4.0216	(80)

Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	495.4899	573.7955	630.8703	688.4363	716.8061	701.6682	675.6194	642.6149	607.1345	544.6968	493.1433	473.8740	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0441	48.2366	48.4267	49.3404	49.5151	50.3453	50.3453	50.5021	50.0223	49.5151	49.1628	48.7999	
alpha	4.2029	4.2158	4.2284	4.2894	4.3010	4.3564	4.3564	4.3668	4.3348	4.3010	4.2775	4.2533	
util living area	0.9649	0.9373	0.8897	0.7883	0.6443	0.4712	0.3418	0.3736	0.5752	0.8214	0.9365	0.9697	(86)
MIT	19.8147	20.0702	20.3748	20.7075	20.8995	20.9801	20.9961	20.9942	20.9530	20.7027	20.2252	19.7842	(87)
Th 2	19.9952	19.9988	20.0024	20.0190	20.0221	20.0367	20.0367	20.0394	20.0311	20.0221	20.0158	20.0092	(88)
util rest of house	0.9571	0.9244	0.8678	0.7508	0.5900	0.4042	0.2680	0.2971	0.5042	0.7803	0.9211	0.9630	(89)
MIT 2	18.6507	18.9686	19.3401	19.7365	19.9396	20.0247	20.0352	20.0370	19.9996	19.7441	19.1782	18.6230	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	19.2559	19.5414	19.8782	20.2414	20.4388	20.5215	20.5348	20.5348	20.4954	20.2425	19.7227	19.2268	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2559	19.5414	19.8782	20.2414	20.4388	20.5215	20.5348	20.5348	20.4954	20.2425	19.7227	19.2268	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9501	0.9175	0.8648	0.7598	0.6138	0.4383	0.3063	0.3368	0.5390	0.7903	0.9158	0.9564	(94)
Useful gains	470.7650	526.4395	545.5851	523.0812	439.9669	307.5422	206.9698	216.4206	327.2664	430.4552	451.6213	453.2057	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	827.7272	807.0871	734.5560	611.1939	469.2740	312.7402	207.8176	217.6991	339.9511	517.8063	682.6971	818.7702	(97)
Space heating kWh	265.5799	188.5952	140.5944	63.4411	21.8045	0.0000	0.0000	0.0000	0.0000	64.9892	166.3746	271.9800	(98a)
Space heating requirement - total per year (kWh/year)												1183.3589	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	265.5799	188.5952	140.5944	63.4411	21.8045	0.0000	0.0000	0.0000	0.0000	64.9892	166.3746	271.9800	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1183.3589	
Space heating per m2										(98c) / (4) =		23.6672	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	265.5799	188.5952	140.5944	63.4411	21.8045	0.0000	0.0000	0.0000	0.0000	64.9892	166.3746	271.9800	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	287.7355	204.3285	152.3233	68.7336	23.6235	0.0000	0.0000	0.0000	0.0000	70.4108	180.2542	294.6696	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.7090	174.1685	185.6654	164.8835	160.9173	146.1892	145.1979	150.3339	151.2738	167.2444	176.0502	194.7887	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.7336	84.2386	83.4444	82.1124	80.7770	79.8000	79.8000	79.8000	79.8000	82.1294	83.9332	84.8085	(217)
Fuel for water heating, kWh/month	232.1498	206.7561	222.5018	200.8023	199.2119	183.1945	181.9523	188.3884	189.5662	203.6353	209.7504	229.6807	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1282.0790	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2447.5897	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3528.9959	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1282.0790	0.2100	269.2366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2447.5897	0.2100	513.9938	(264)
Space and water heating			783.2304	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			759.7203	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.1900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1282.0790	1.1300	1448.7493	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2447.5897	1.1300	2765.7763	(278)
Space and water heating			4214.5256	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4089.3332	(286)
Target Primary Energy Rate (TPER)			81.7900	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 7	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	87 B	**DER**	4.13	**TER**	17.52
Environmental	98 A	**% DER < TER**			76.43
CO_2 Emissions (t/year)	0.16	**DFEE**	27.86	**TFEE**	34.69
Compliance Check	See BREL	**% DFEE < TFEE**			19.69
% DPER < TPER	50.74	**DPER**	46.64	**TPER**	94.68

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000 (1b)	x	2.6000 (2b)	=	101.4000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	39.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	101.4000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			7.6400	0.7752	5.9225			(27)
EXTERNAL	36.0400	9.9800	26.0600	0.1400	3.6484	70.0000	1824.2000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		12.5115			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			39.0000			40.0000	1560.0000	(32d)
Party Ceiling 1			39.0000			30.0000	1170.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8958.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		229.6974 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	5.8000	0.3000	1.7400	
E3 Sill	4.8000	0.0400	0.1920	
E4 Jamb	13.3400	0.0500	0.6670	
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	2.6000	0.0600	0.1560	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6058 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 18.1173 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.5785	9.4530	9.3275	8.7001	8.5746	7.9472	7.9472	7.8217	8.1982	8.5746	8.8256	9.0766	(38)
Heat transfer coeff	27.6958	27.5703	27.4448	26.8174	26.6919	26.0645	26.0645	25.9390	26.3155	26.6919	26.9429	27.1938	(39)
Average = Sum(39)m / 12 =												26.7860	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7101	0.7069	0.7037	0.6876	0.6844	0.6683	0.6683	0.6651	0.6748	0.6844	0.6908	0.6973	(40)
HLP (average)												0.6868	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3800 (42)
Hot water usage for mixer showers

53.2775	52.4768	51.3101	49.0778	47.4304	45.5933	44.5491	45.7069	46.9762	48.9487	51.2290	53.0734	(42a)

Hot water usage for baths

20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)

Hot water usage for other uses

28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)

Average daily hot water use (litres/day) 94.2642 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.5289	100.3780	97.7369	93.6686	90.3837	86.8447	85.4461	88.0754	90.8539	94.5742	98.7067	102.2555	(44)
Energy conte	162.3807	142.9370	150.2179	128.2276	121.6738	106.7856	103.3396	109.0557	112.0319	128.3364	140.6259	160.1074	(45)
Energy content (annual)										Total = Sum(45)m =		1565.7195	
Distribution loss (46)m = 0.15 x (45)m	24.3571	21.4405	22.5327	19.2341	18.2511	16.0178	15.5009	16.3584	16.8048	19.2505	21.0939	24.0161	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

220.7971	195.7002	208.6343	184.7596	180.0902	163.3176	161.7560	167.4721	168.5639	186.7528	197.1579	218.5238	(62)
WWHRS -41.0809	-36.3323	-38.0450	-31.5028	-29.3595	-25.1231	-23.5489	-25.0419	-25.9933	-30.6433	-34.7151	-40.3201	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
179.7162	159.3679	170.5893	153.2568	150.7308	138.1945	138.2071	142.4302	142.5706	156.1095	162.4427	178.2037	(64)
								Total per year (kWh/year) = Sum(64)m =			1871.8193	(64)
12Total per year (kWh/year)											1872	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month												
100.7247	89.7371	96.6806	87.8613	87.1897	80.7318	81.0936	82.9942	82.4762	89.4050	91.9837	99.9688	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.8268	68.4511	61.8268	63.8877	61.8268	63.8877	61.8268	61.8268	63.8877	61.8268	63.8877	61.8268	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)	135.3827	133.5373	129.9470	122.0296	117.1904	112.1275	108.9967	111.5513	114.5503	120.1680	127.7551	134.3667	(72)
Total internal gains	359.9366	365.9507	352.6236	340.1410	324.8767	314.0134	303.5699	304.8894	313.0618	323.2446	341.2570	353.6689	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
West	0.7200	19.6403	0.5700	0.7000	0.7700	3.9101	(80)

Solar gains 41.4903	81.1639	133.6653	194.9429	238.9099	244.5668	232.8375	200.0040	155.4583	96.3078	51.7336	34.1196	(83)
Total gains 401.4269	447.1146	486.2890	535.0839	563.7865	558.5802	536.4075	504.8934	468.5201	419.5524	392.9905	387.7885	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	89.8472	90.2562	90.6688	92.7901	93.2263	95.4704	95.4704	95.9323	94.5599	93.2263	92.3579	91.5056	
alpha	6.9898	7.0171	7.0446	7.1860	7.2151	7.3647	7.3647	7.3955	7.3040	7.2151	7.1572	7.1004	
util living area	0.9276	0.8721	0.7731	0.5998	0.4396	0.2986	0.2138	0.2363	0.3873	0.6499	0.8553	0.9358	(86)
Living	20.7941	20.8237	20.8499	20.8673	20.8704	20.8733	20.8733	20.8738	20.8722	20.8667	20.8387	20.7929	
Non living	20.0813	20.1184	20.1502	20.1826	20.1885	20.2063	20.2063	20.2098	20.1992	20.1853	20.1504	20.0912	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8947	20.8237	20.8499	20.8673	20.8704	20.8733	20.8733	20.8738	20.8722	20.8667	20.8387	20.8219	(87)
Th 2	20.3319	20.3347	20.3376	20.3518	20.3546	20.3689	20.3689	20.3718	20.3632	20.3546	20.3489	20.3432	(88)
util rest of house	0.9143	0.8526	0.7462	0.5694	0.4094	0.2692	0.1831	0.2040	0.3517	0.6129	0.8314	0.9237	(89)
MIT 2	20.2320	20.1184	20.1502	20.1826	20.1885	20.2063	20.2063	20.2098	20.1992	20.1853	20.1504	20.1366	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	20.7248	20.6429	20.6705	20.6917	20.6955	20.7023	20.7023	20.7036	20.6996	20.6920	20.6622	20.6462	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.7248	20.6429	20.6705	20.6917	20.6955	20.7023	20.7023	20.7036	20.6996	20.6920	20.6622	20.6462	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9224	0.8619	0.7600	0.5854	0.4254	0.2847	0.1993	0.2211	0.3705	0.6324	0.8432	0.9295	(94)
Useful gains	370.2637	385.3652	369.5677	313.2303	239.8161	159.0413	106.9229	111.6288	173.5938	265.3257	331.3749	360.4568	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	454.8967	434.0352	388.9064	316.2236	240.1079	159.0522	106.9234	111.6300	173.6716	269.3746	365.4045	447.2348	(97)
Space heating kWh	62.9670	32.7062	14.3880	2.1552	0.2171	0.0000	0.0000	0.0000	0.0000	3.0124	24.5013	64.5629	(98a)
Space heating requirement - total per year (kWh/year)												204.5101	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	62.9670	32.7062	14.3880	2.1552	0.2171	0.0000	0.0000	0.0000	0.0000	3.0124	24.5013	64.5629	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												204.5101	
Space heating per m2										(98c) / (4) =		5.2438	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 190.8327 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	62.9670	32.7062	14.3880	2.1552	0.2171	0.0000	0.0000	0.0000	0.0000	3.0124	24.5013	64.5629	(98)
Space heating efficiency (main heating system 1)	190.8327	190.8327	190.8327	190.8327	190.8327	0.0000	0.0000	0.0000	0.0000	190.8327	190.8327	190.8327	(210)
Space heating fuel (main heating system)	32.9959	17.1387	7.5396	1.1294	0.1138	0.0000	0.0000	0.0000	0.0000	1.5785	12.8391	33.8322	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	179.7162	159.3679	170.5893	153.2568	150.7308	138.1945	138.2071	142.4302	142.5706	156.1095	162.4427	178.2037	(64)
Efficiency of water heater												264.7084	(216)
(217)m	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	264.7084	(217)
Fuel for water heating, kWh/month	67.8922	60.2051	64.4442	57.8965	56.9422	52.2063	52.2111	53.8065	53.8595	58.9741	61.3667	67.3208	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	10.8849	9.8316	10.8849	10.5338	10.8849	10.5338	10.8849	10.8849	10.5338	10.8849	10.5338	10.8849	(231)
Lighting	13.4326	10.7761	9.7027	7.1086	5.4909	4.4861	5.0090	6.5109	8.4570	11.0960	12.5329	13.8059	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-6.3106	-10.9175	-19.5069	-26.4848	-32.3577	-31.6764	-31.0884	-27.2126	-20.9416	-13.9297	-7.4744	-5.1762	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.1175	-3.0171	-7.9199	-14.9872	-22.4960	-23.6196	-22.9081	-17.6417	-10.8536	-4.9263	-1.6494	-0.8234	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												107.1672	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												264.7084	
Water heating fuel used												707.1251	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)

mechanical ventilation fans (SFP = 1.0360)	128.1615	(230a)
Total electricity for the above, kWh/year	128.1615	(231)
Electricity for lighting (calculated in Appendix L)	108.4087	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-365.0365	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	685.8260	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	107.1672	0.1597	17.1186	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	707.1251	0.1404	99.2723	(264)
Space and water heating			116.3909	(265)
Pumps, fans and electric keep-hot	128.1615	0.1387	17.7776	(267)
Energy for lighting	108.4087	0.1443	15.6467	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-233.0768	0.1310	-30.5400	
PV Unit electricity exported	-131.9598	0.1208	-15.9399	
Total			-46.4799	(269)
Total CO2, kg/year			103.3354	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.6500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	107.1672	1.5912	170.5249	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	707.1251	1.5191	1074.1800	(278)
Space and water heating			1244.7049	(279)
Pumps, fans and electric keep-hot	128.1615	1.5128	193.8827	(281)
Energy for lighting	108.4087	1.5338	166.2809	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-233.0768	1.4841	-345.8997	
PV Unit electricity exported	-131.9598	0.4432	-58.4781	
Total			-404.3778	(283)
Total Primary energy kWh/year			1200.4907	(286)
Dwelling Primary energy Rate (DPER)			30.7800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.0000	(1b)	x 2.6000	(2b) =	101.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 39.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	101.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1972	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4472	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4472	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)

Adj infilt rate												
	0.5702	0.5590	0.5479	0.4920	0.4808	0.4249	0.4249	0.4137	0.4472	0.4808	0.5031	0.5255 (22b)
Effective ac	0.6626	0.6563	0.6501	0.6210	0.6156	0.5903	0.5903	0.5856	0.6000	0.6156	0.6266	0.6381 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			7.4100	1.1450	8.4847			(27)
EXTERNAL	36.0400	9.7500	26.2900	0.1800	4.7322			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
Total net area of external elements Aum(A, m2)			44.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.0365			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	239.6974	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900
E3 Sill	4.8000	0.0500	0.2400
E4 Jamb	13.3400	0.0500	0.6670
E7 Party floor between dwellings (in blocks of flats)	34.0400	0.0700	2.3828
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	2.6000	0.0600	0.1560
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2038	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	21.2403	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.1713	21.9600	21.7530	20.7804	20.5984	19.7513	19.7513	19.5944	20.0776	20.5984	20.9665	21.3514	(38)
Heat transfer coeff	43.4116	43.2004	42.9933	42.0207	41.8387	40.9916	40.9916	40.8347	41.3179	41.8387	42.2068	42.5917	(39)
Average = Sum(39)m / 12 =												42.0198	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1131	1.1077	1.1024	1.0775	1.0728	1.0511	1.0511	1.0470	1.0594	1.0728	1.0822	1.0921	(40)
HLP (average)												1.0774	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.3800	(42)

Hot water usage for mixer showers													
	47.3578	46.6461	45.6090	43.6247	42.1604	40.5274	39.5992	40.6284	41.7566	43.5100	45.5369	47.1763	(42a)
Hot water usage for baths													
	20.4886	20.1843	19.7558	18.9658	18.3742	17.7182	17.3639	17.7894	18.2526	18.9546	19.7609	20.4194	(42b)
Hot water usage for other uses													
	28.7628	27.7168	26.6709	25.6250	24.5791	23.5332	23.5332	24.5791	25.6250	26.6709	27.7168	28.7628	(42c)
Average daily hot water use (litres/day)												88.8064	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	96.6092	94.5473	92.0358	88.2155	85.1137	81.7787	80.4962	82.9968	85.6343	89.1355	93.0146	96.3584	(44)
Energy conte	153.0053	134.6340	141.4555	120.7626	114.5793	100.5565	97.3532	102.7674	105.5956	120.9560	132.5164	150.8740	(45)
Energy content (annual)										Total = Sum(45)m =		1475.0560	
Distribution loss (46)m = 0.15 x (45)m													
	22.9508	20.1951	21.2183	18.1144	17.1869	15.0835	14.6030	15.4151	15.8393	18.1434	19.8775	22.6311	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	203.9314	180.6318	192.3816	170.0459	165.5054	149.8398	148.2792	153.6935	154.8789	171.8821	181.7997	201.8001	(62)
WWHRS	-21.6500	-19.1474	-20.0501	-16.6023	-15.4727	-13.2401	-12.4105	-13.1973	-13.6987	-16.1493	-18.2952	-21.2491	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	182.2814	161.4843	172.3315	153.4436	150.0327	136.5997	135.8688	140.4962	141.1802	155.7328	163.5045	180.5510	(64)
										Total per year (kWh/year) = Sum(64)m =		1873.5067	(64)
12Total per year (kWh/year)												1874	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	91.6151	81.5640	87.7748	79.5802	78.8385	72.8617	73.1108	74.9110	74.5372	80.9587	83.4883	90.9065	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	69.0009	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	60.8308	67.3484	60.8308	62.8585	60.8308	62.8585	60.8308	60.8308	62.8585	60.8308	62.8585	60.8308	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	119.0269	120.2620	117.1495	110.5234	102.1592	94.2979	89.0462	87.8110	90.9235	97.5496	105.9139	113.7751	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	29.9001	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	-55.2007	(71)
Water heating gains (Table 5)												
	123.1386	121.3750	117.9769	110.5281	105.9657	101.1968	98.2672	100.6869	103.5239	108.8155	115.9560	122.1861 (72)
Total internal gains												
	349.6965	355.6856	342.6575	330.6102	315.6559	302.0534	291.8444	293.0289	301.0061	313.8962	331.4286	343.4923 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.7100	19.6403	0.6300	0.7000	0.7700	40.2756	(76)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	44.4772	87.0068	143.2878	208.9768	256.1089	262.1730	249.5994	214.4022	166.6497	103.2409	55.4578	36.5759 (83)
Total gains	394.1737	442.6925	485.9453	539.5870	571.7648	564.2264	541.4438	507.4311	467.6558	417.1371	386.8865	380.0681 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8163	60.1088	60.3983	61.7963	62.0651	63.3476	63.3476	63.5910	62.8474	62.0651	61.5237	60.9678	
alpha	4.9878	5.0073	5.0266	5.1198	5.1377	5.2232	5.2232	5.2394	5.1898	5.1377	5.1016	5.0645	
util living area													
	0.9776	0.9595	0.9189	0.8108	0.6473	0.4604	0.3324	0.3689	0.5905	0.8542	0.9558	0.9806	(86)
MIT	20.0283	20.2245	20.4929	20.7956	20.9452	20.9925	20.9989	20.9981	20.9741	20.7728	20.3758	20.0151	(87)
Th 2	20.4434	20.4461	20.4488	20.4613	20.4636	20.4745	20.4745	20.4765	20.4703	20.4636	20.4589	20.4540	(88)
util rest of house													
	0.9744	0.9539	0.9083	0.7898	0.6162	0.4239	0.2930	0.3274	0.5500	0.8325	0.9489	0.9778	(89)
MIT 2	19.5372	19.7322	19.9949	20.2894	20.4222	20.4698	20.4739	20.4755	20.4529	20.2751	19.8928	19.5328	(90)
Living area fraction										fLA = Living area / (4) =		0.7436	(91)
MIT	19.9024	20.0983	20.3652	20.6658	20.8111	20.8585	20.8643	20.8641	20.8405	20.6452	20.2520	19.8915	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9024	20.0983	20.3652	20.6658	20.8111	20.8585	20.8643	20.8641	20.8405	20.6452	20.2520	19.8915	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9708	0.9501	0.9066	0.7980	0.6365	0.4506	0.3222	0.3582	0.5785	0.8402	0.9460	0.9744	(94)
Useful gains	382.6506	420.5833	440.5360	430.5647	363.9369	254.2472	174.4768	181.7434	270.5337	350.4764	365.9909	370.3495	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	677.3235	656.5700	596.1111	494.4055	381.1977	256.5444	174.7997	182.2913	278.5032	420.2777	555.1025	668.3257	(97)
Space heating kWh													
	219.2366	158.5831	115.7479	45.9654	12.8421	0.0000	0.0000	0.0000	0.0000	51.9322	136.1603	221.6943	(98a)
Space heating requirement - total per year (kWh/year)												962.1618	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	219.2366	158.5831	115.7479	45.9654	12.8421	0.0000	0.0000	0.0000	0.0000	51.9322	136.1603	221.6943	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												962.1618	
Space heating per m2											(98c) / (4) =	24.6708	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	219.2366	158.5831	115.7479	45.9654	12.8421	0.0000	0.0000	0.0000	0.0000	51.9322	136.1603	221.6943	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	237.5261	171.8126	125.4040	49.8000	13.9134	0.0000	0.0000	0.0000	0.0000	56.2645	147.5193	240.1889	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	182.2814	161.4843	172.3315	153.4436	150.0327	136.5997	135.8688	140.4962	141.1802	155.7328	163.5045	180.5510	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.4748	84.0191	83.1876	81.7089	80.4428	79.8000	79.8000	79.8000	79.8000	81.8752	83.6523	84.5213	(217)
Fuel for water heating, kWh/month													
	215.7819	192.1995	207.1602	187.7931	186.5085	171.1775	170.2616	176.0604	176.9175	190.2076	195.4572	213.6161	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	12.6394	10.1398	9.1298	6.6889	5.1667	4.2212	4.7132	6.1264	7.9576	10.4408	11.7929	12.9907	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.5051	-11.4259	-17.7250	-21.5712	-24.7560	-23.6831	-23.4153	-21.3606	-18.0067	-13.7752	-8.5514	-6.3952	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.0121	-4.3759	-8.9665	-13.8670	-18.7247	-18.9396	-18.6975	-15.6360	-11.2211	-6.3662	-2.7219	-1.5795	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1042.4288	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2283.1411	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	102.0075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-321.2788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3192.2985	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1042.4288	0.2100	218.9101	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2283.1411	0.2100	479.4596	(264)
Space and water heating			698.3697	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	102.0075	0.1443	14.7228	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	0.1330	-26.3533	
PV Unit electricity exported	-123.1080	0.1251	-15.3980	
Total			-41.7513	(269)
Total CO2, kg/year			683.2705	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.5200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1042.4288	1.1300	1177.9446	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2283.1411	1.1300	2579.9494	(278)
Space and water heating			3757.8940	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	102.0075	1.5338	156.4624	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-198.1708	1.4914	-295.5498	
PV Unit electricity exported	-123.1080	0.4591	-56.5166	
Total			-352.0664	(283)
Total Primary energy kWh/year			3692.3908	(286)
Target Primary Energy Rate (TPER)			94.6800	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 8	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	93 A	**DER**	1.49	**TER**	12.31
Environmental	99 A	**% DER < TER**			87.90
CO_2 Emissions (t/year)	0.1	**DFEE**	25.97	**TFEE**	31.17
Compliance Check	See BREL	**% DFEE < TFEE**			16.70
% DPER < TPER	71.64	**DPER**	18.64	**TPER**	65.74

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	81.0000	(1b)	x 2.6000	(2b) =	210.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.0000					
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	210.6000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			23.9100	0.7752	18.5349			(27)
EXTERNAL	79.9200	26.2500	53.6700	0.1400	7.5138	70.0000	3756.9000	(29a)
External Roof 1	14.8900		14.8900	0.1000	1.4890	9.0000	134.0100	(30)
Total net area of external elements Aum(A, m2)			94.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4097			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000	180.0000	3828.6000	(32)
Party Floor 1			81.0000			40.0000	3240.0000	(32d)
Party Ceiling 1			66.1100			30.0000	1983.3000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12942.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.7878 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.6600	0.3000	3.7980	
E3 Sill	7.0000	0.0400	0.2800	
E4 Jamb	31.1800	0.0500	1.5590	
E7 Party floor between dwellings (in blocks of flats)	48.5600	0.0700	3.3992	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000	
E14 Flat roof	12.9200	0.0400	0.5168	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5670 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 39.9767 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	19.8938	19.6332	19.3726	18.0695	17.8089	16.5058	16.5058	16.2452	17.0270	17.8089	18.3301	18.8513	(38)
Heat transfer coeff	59.8705	59.6099	59.3493	58.0462	57.7855	56.4825	56.4825	56.2218	57.0037	57.7855	58.3068	58.8280	(39)
Average = Sum(39)m / 12 =												57.9810	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7391	0.7359	0.7327	0.7166	0.7134	0.6973	0.6973	0.6941	0.7037	0.7134	0.7198	0.7263	(40)
HLP (average)												0.7158	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4816 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	74.0558	72.9428	71.3211	68.2182	65.9284	63.3747	61.9232	63.5327	65.2970	68.0388	71.2083	73.7720	(42a)
Hot water usage for baths	29.9275	29.4830	28.8571	27.7031	26.8390	25.8808	25.3632	25.9847	26.6614	27.6867	28.8646	29.8263	(42b)
Hot water usage for other uses	42.1512	40.6185	39.0857	37.5529	36.0201	34.4874	34.4874	36.0201	37.5529	39.0857	40.6185	42.1512	(42c)
Average daily hot water use (litres/day)												134.3437	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1345	143.0443	139.2639	133.4742	128.7874	123.7429	121.7738	125.5376	129.5113	134.8112	140.6913	145.7496	(44)
Energy conte	231.4413	203.6932	214.0435	182.7195	173.3727	152.1563	147.2749	155.4417	159.7004	182.9375	200.4406	228.2086	(45)
Energy content (annual)										Total = Sum(45)m =		2231.4303	
Distribution loss (46)m = 0.15 x (45)m	34.7162	30.5540	32.1065	27.4079	26.0059	22.8234	22.0912	23.3163	23.9551	27.4406	30.0661	34.2313	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	289.8577	256.4564	272.4599	239.2515	231.7891	208.6883	205.6913	213.8581	216.2324	241.3539	256.9726	286.6250	(62)
WWHRS	-57.1024	-50.5019	-52.8826	-43.7889	-40.8097	-34.9211	-32.7330	-34.8083	-36.1308	-42.5942	-48.2540	-56.0450	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	232.7553	205.9546	219.5772	195.4626	190.9794	173.7671	172.9583	179.0499	180.1017	198.7598	208.7186	230.5800	(64)
										Total per year (kWh/year) = Sum(64)m =		2388.6643	(64)
12Total per year (kWh/year)												2389	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	123.6874	109.9386	117.9026	105.9798	104.3795	95.8176	95.7020	98.4175	98.3260	107.5599	111.8721	122.6125	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.7303	123.7014	111.7303	115.4546	111.7303	115.4546	111.7303	111.7303	115.4546	111.7303	115.4546	111.7303	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.5178	223.8165	218.0239	205.6923	190.1258	175.4954	165.7215	163.4228	169.2154	181.5470	197.1135	211.7439	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	(71)
Water heating gains (Table 5)	166.2464	163.5990	158.4712	147.1942	140.2951	133.0799	128.6317	132.2816	136.5639	144.5697	155.3779	164.8017	(72)
Total internal gains	559.7180	571.3404	548.4489	528.5646	502.3745	484.2535	466.3069	467.6581	481.4573	498.0705	528.1695	548.4993	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	6.9200	19.6403	0.5700	0.7000	0.7700	37.5802	(76)
South	12.1300	46.7521	0.5700	0.7000	0.7700	156.8078	(78)
West	0.3600	19.6403	0.5700	0.7000	0.7700	1.9550	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	209.5740	359.4352	497.4638	624.5001	705.9008	703.3476	677.0600	616.1182	541.5187	398.8627	251.4887	179.0382	(83)

Total gains	769.2920	930.7755	1045.9126	1153.0646	1208.2753	1187.6010	1143.3669	1083.7764	1022.9761	896.9332	779.6582	727.5376	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0500	60.3126	60.5774	61.9373	62.2167	63.6521	63.6521	63.9471	63.0700	62.2167	61.6605	61.1142	
alpha	5.0033	5.0208	5.0385	5.1292	5.1478	5.2435	5.2435	5.2631	5.2047	5.1478	5.1107	5.0743	
util living area													
	0.9216	0.8464	0.7439	0.5895	0.4409	0.3040	0.2173	0.2385	0.3829	0.6393	0.8521	0.9340	(86)
Living	20.6639	20.7259	20.7728	20.8070	20.8170	20.8224	20.8226	20.8233	20.8205	20.8050	20.7422	20.6566	
Non living	19.8969	19.9737	20.0305	20.0822	20.0952	20.1155	20.1156	20.1193	20.1077	20.0839	20.0082	19.8990	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8281	20.7259	20.7728	20.8070	20.8170	20.8224	20.8226	20.8233	20.8205	20.8050	20.7422	20.7046	(87)
Th 2	20.3064	20.3092	20.3120	20.3262	20.3290	20.3432	20.3432	20.3461	20.3375	20.3290	20.3233	20.3177	(88)
util rest of house													
	0.9103	0.8283	0.7193	0.5604	0.4101	0.2729	0.1849	0.2047	0.3466	0.6044	0.8317	0.9241	(89)
MIT 2	20.1431	19.9737	20.0305	20.0822	20.0952	20.1155	20.1156	20.1193	20.1077	20.0839	20.0082	19.9744	(90)
Living area fraction										fLA = Living area / (4) =		0.3457	(91)
MIT	20.3799	20.2338	20.2871	20.3327	20.3447	20.3598	20.3600	20.3627	20.3541	20.3332	20.2619	20.2268	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3799	20.2338	20.2871	20.3327	20.3447	20.3598	20.3600	20.3627	20.3541	20.3332	20.2619	20.2268	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9116	0.8263	0.7184	0.5607	0.4109	0.2737	0.1857	0.2055	0.3476	0.6046	0.8297	0.9227	(94)
Useful gains	701.2762	769.0584	751.3556	646.4838	496.4201	325.0645	212.3504	222.7448	355.5413	542.3130	646.8587	671.3057	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	962.7111	914.0428	818.2559	663.6265	499.5399	325.3305	212.3758	222.7876	356.5050	562.4358	767.4274	942.8268	(97)
Space heating kWh													
	194.5076	97.4296	49.7738	12.3428	2.3211	0.0000	0.0000	0.0000	0.0000	14.9713	86.8095	202.0117	(98a)
Space heating requirement - total per year (kWh/year)												660.1674	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	194.5076	97.4296	49.7738	12.3428	2.3211	0.0000	0.0000	0.0000	0.0000	14.9713	86.8095	202.0117	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												660.1674	
Space heating per m2											(98c) / (4) =	8.1502	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												325.5995	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	194.5076	97.4296	49.7738	12.3428	2.3211	0.0000	0.0000	0.0000	0.0000	14.9713	86.8095	202.0117	(98)
Space heating efficiency (main heating system 1)													
	325.5995	325.5995	325.5995	325.5995	325.5995	0.0000	0.0000	0.0000	0.0000	325.5995	325.5995	325.5995	(210)
Space heating fuel (main heating system)													
	59.7383	29.9231	15.2868	3.7908	0.7129	0.0000	0.0000	0.0000	0.0000	4.5981	26.6614	62.0430	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	232.7553	205.9546	219.5772	195.4626	190.9794	173.7671	172.9583	179.0499	180.1017	198.7598	208.7186	230.5800	(64)
Efficiency of water heater												463.3541	(216)
(217)m	463.3541	463.3541	463.3541	463.3541	463.3541	463.3541	463.3541	463.3541	463.3541	463.3541	463.3541	463.3541	(217)
Fuel for water heating, kWh/month													
	50.2327	44.4486	47.3886	42.1843	41.2167	37.5020	37.3274	38.6421	38.8691	42.8959	45.0452	49.7632	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	22.6072	20.4194	22.6072	21.8779	22.6072	21.8779	22.6072	22.6072	21.8779	22.6072	21.8779	22.6072	(231)
Lighting	28.9620	23.2344	20.9200	15.3269	11.8389	9.6725	10.7999	14.0381	18.2341	23.9241	27.0222	29.7669	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.8107	-21.8453	-38.3901	-51.1083	-61.3604	-59.6090	-58.5078	-51.6763	-40.4320	-27.5294	-15.0723	-10.5333	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6645	-7.1851	-18.7491	-35.2917	-52.9180	-55.5910	-53.9850	-41.7701	-25.8080	-11.7538	-3.9357	-1.9659	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												202.7545	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												463.3541	
Water heating fuel used												515.5160	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	266.1816	(230a)
Total electricity for the above, kWh/year	266.1816	(231)
Electricity for lighting (calculated in Appendix L)	233.7398	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-760.4928	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	457.6990	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	202.7545	0.1591	32.2643	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	515.5160	0.1406	72.4837	(264)
Space and water heating			104.7481	(265)
Pumps, fans and electric keep-hot	266.1816	0.1387	36.9227	(267)
Energy for lighting	233.7398	0.1443	33.7359	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-448.8748	0.1314	-58.9699	
PV Unit electricity exported	-311.6180	0.1208	-37.6518	
Total			-96.6216	(269)
Total CO2, kg/year			78.7850	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.9700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	202.7545	1.5890	322.1690	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	515.5160	1.5199	783.5269	(278)
Space and water heating			1105.6959	(279)
Pumps, fans and electric keep-hot	266.1816	1.5128	402.6795	(281)
Energy for lighting	233.7398	1.5338	358.5179	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-448.8748	1.4853	-666.7359	
PV Unit electricity exported	-311.6180	0.4433	-138.1316	
Total			-804.8676	(283)
Total Primary energy kWh/year			1062.0257	(286)
Dwelling Primary energy Rate (DPER)			13.1100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	81.0000	(1b) x	2.6000	(2b) =	210.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	210.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3925	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3925	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.5004	0.4906	0.4808	0.4317	0.4219	0.3728	0.3728	0.3630	0.3925	0.4219	0.4415	0.4611	(22b)
Effective ac	0.6252	0.6203	0.6156	0.5932	0.5890	0.5695	0.5695	0.5659	0.5770	0.5890	0.5975	0.6063	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			17.9100	1.1450	20.5076			(27)
EXTERNAL	79.9200	20.2500	59.6700	0.1800	10.7406			(29a)
External Roof 1	14.8900		14.8900	0.1100	1.6379			(30)
Total net area of external elements Aum(A, m2)			94.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2261			(33)
Main dwelling								
Party Wall 1			21.2700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 167.9495 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.6600	0.0500	0.6330
E3 Sill	7.0000	0.0500	0.3500
E4 Jamb	31.1800	0.0500	1.5590
E7 Party floor between dwellings (in blocks of flats)	48.5600	0.0700	3.3992
E16 Corner (normal)	7.8000	0.0900	0.7020
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.3600	0.0000	0.0000
E14 Flat roof	12.9200	0.0800	1.0336

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9888 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 43.2149 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4492	43.1114	42.7803	41.2248	40.9338	39.5791	39.5791	39.3283	40.1009	40.9338	41.5225	42.1380	(38)
Heat transfer coeff													
	86.6642	86.3263	85.9952	84.4398	84.1488	82.7941	82.7941	82.5432	83.3159	84.1488	84.7375	85.3530	(39)
Average = Sum(39)m / 12 =												84.4384	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0699	1.0658	1.0617	1.0425	1.0389	1.0221	1.0221	1.0191	1.0286	1.0389	1.0461	1.0537	(40)
HLP (average)												1.0424	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4816 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.8273	64.8381	63.3965	60.6384	58.6030	56.3331	55.0429	56.4735	58.0417	60.4789	63.2963	65.5751	(42a)

Hot water usage for baths

28.4311	28.0089	27.4143	26.3179	25.4970	24.5867	24.0950	24.6855	25.3284	26.3024	27.4213	28.3350	(42b)

Hot water usage for other uses

40.0437	38.5875	37.1314	35.6753	34.2191	32.7630	32.7630	34.2191	35.6753	37.1314	38.5875	40.0437	(42c)

Average daily hot water use (litres/day) 123.4541 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	134.3021	131.4345	127.9422	122.6316	118.3191	113.6828	111.9009	115.3781	119.0454	123.9127	129.3052	133.9538	(44)
Energy conte	212.7018	187.1610	196.6424	167.8766	159.2803	139.7863	135.3345	142.8622	146.7949	168.1484	184.2189	209.7393	(45)
Energy content (annual)										Total = Sum(45)m =		2050.5464	
Distribution loss (46)m = 0.15 x (45)m													
	31.9053	28.0741	29.4964	25.1815	23.8920	20.9679	20.3002	21.4293	22.0192	25.2223	27.6328	31.4609	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	263.6278	233.1587	247.5685	217.1598	210.2064	189.0696	186.2605	193.7883	196.0782	219.0745	233.5022	260.6654	(62)
WWHRS	-30.0935	-26.6149	-27.8696	-23.0772	-21.5071	-18.4038	-17.2506	-18.3443	-19.0412	-22.4475	-25.4303	-29.5362	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	233.5343	206.5438	219.6989	194.0827	188.6993	170.6658	169.0099	175.4440	177.0369	196.6269	208.0719	231.1291	(64)
										Total per year (kWh/year) = Sum(64)m =		2370.5436	(64)
12Total per year (kWh/year)												2371	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)													
Heat gains from water heating, kWh/month													
	111.4642	99.0292	106.1245	95.2456	93.7016	85.9056	85.7396	88.2425	88.2359	96.6502	100.6794	110.4792	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	111.7521	123.7256	111.7521	115.4772	111.7521	115.4772	111.7521	111.7521	115.4772	111.7521	115.4772	111.7521	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.5178	223.8165	218.0239	205.6923	190.1258	175.4954	165.7215	163.4228	169.2154	181.5470	197.1135	211.7439	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	(71)
Water heating gains (Table 5)													
	149.8175	147.3649	142.6404	132.2855	125.9429	119.3133	115.2414	118.6056	122.5499	129.9062	139.8325	148.4935	(72)
Total internal gains													
	546.3108	558.1304	535.6399	516.6784	491.0443	470.5094	452.9384	454.0040	467.4659	486.4288	515.6467	535.2129	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3700	10.6334	0.6300	0.7000	0.7700	10.9515	(74)
East	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920	(76)
South	9.0900	46.7521	0.6300	0.7000	0.7700	129.8783	(78)
West	0.2700	19.6403	0.6300	0.7000	0.7700	1.6206	(80)

Solar gains	173.5424	297.6289	411.9016	517.0582	584.4315	582.3087	560.5486	510.1093	448.3687	330.2706	208.2489	148.2578	(83)
Total gains	719.8533	855.7593	947.5415	1033.7367	1075.4757	1052.8181	1013.4870	964.1132	915.8346	816.6994	723.8957	683.4707	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.6035	43.7742	43.9427	44.7522	44.9069	45.6417	45.6417	45.7804	45.3559	44.9069	44.5950	44.2734	
alpha	3.9069	3.9183	3.9295	3.9835	3.9938	4.0428	4.0428	4.0520	4.0237	3.9938	3.9730	3.9516	
util living area													
	0.9661	0.9367	0.8899	0.7946	0.6577	0.4872	0.3557	0.3883	0.5880	0.8264	0.9389	0.9713	(86)
MIT	19.6294	19.9265	20.2626	20.6324	20.8617	20.9688	20.9931	20.9902	20.9330	20.6321	20.0863	19.5904	(87)
Th 2	20.0255	20.0289	20.0323	20.0481	20.0511	20.0649	20.0649	20.0675	20.0596	20.0511	20.0451	20.0388	(88)
util rest of house													
	0.9592	0.9248	0.8699	0.7603	0.6064	0.4216	0.2818	0.3120	0.5200	0.7890	0.9253	0.9654	(89)
MIT 2	18.4528	18.8239	19.2366	19.6821	19.9319	20.0445	20.0620	20.0630	20.0116	19.6952	19.0400	18.4133	(90)
Living area fraction										fLA = Living area / (4) =		0.3457	(91)
MIT	18.8595	19.2050	19.5913	20.0106	20.2533	20.3640	20.3838	20.3835	20.3301	20.0191	19.4017	18.8202	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8595	19.2050	19.5913	20.0106	20.2533	20.3640	20.3838	20.3835	20.3301	20.0191	19.4017	18.8202	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9488	0.9127	0.8595	0.7588	0.6178	0.4430	0.3072	0.3382	0.5402	0.7876	0.9142	0.9559	(94)
Useful gains	682.9977	781.0182	814.4141	784.4303	664.4313	466.3777	311.3938	326.0256	494.7716	643.2340	661.8205	653.2981	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1261.7857	1234.8993	1125.7867	938.1729	719.7508	477.2264	313.2780	328.8095	519.0674	792.6057	1042.4123	1247.8789	(97)
Space heating kWh													
	430.6183	305.0081	231.6612	110.6947	41.1578	0.0000	0.0000	0.0000	0.0000	111.1325	274.0261	442.3681	(98a)
Space heating requirement - total per year (kWh/year)												1946.6667	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	430.6183	305.0081	231.6612	110.6947	41.1578	0.0000	0.0000	0.0000	0.0000	111.1325	274.0261	442.3681	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1946.6667	
Space heating per m2											(98c) / (4) =	24.0329	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	430.6183	305.0081	231.6612	110.6947	41.1578	0.0000	0.0000	0.0000	0.0000	111.1325	274.0261	442.3681	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	466.5420	330.4529	250.9872	119.9292	44.5913	0.0000	0.0000	0.0000	0.0000	120.4036	296.8864	479.2721	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	233.5343	206.5438	219.6989	194.0827	188.6993	170.6658	169.0099	175.4440	177.0369	196.6269	208.0719	231.1291	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4128	84.9325	84.1789	82.8498	81.2750	79.8000	79.8000	79.8000	79.8000	82.8315	84.6782	85.4911	(217)
Fuel for water heating, kWh/month													
	273.4185	243.1859	260.9905	234.2586	232.1739	213.8669	211.7919	219.8547	221.8508	237.3819	245.7208	270.3545	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.2199	18.6279	16.7723	12.2881	9.4917	7.7548	8.6586	11.2548	14.6189	19.1808	21.6647	23.8652	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233a)m	-15.2641	-23.0615	-35.4930	-42.8185	-48.7685	-46.4737	-45.9024	-42.0283	-35.6857	-27.6052	-17.3175	-13.0228	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.5025	-9.7576	-19.9433	-30.7839	-41.5376	-42.0502	-41.5626	-34.8107	-25.0182	-14.2269	-6.0963	-3.5400	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2109.0647	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2864.8490	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	187.3978	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-667.2713	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4580.0401	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2109.0647	0.2100	442.9036	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2864.8490	0.2100	601.6183	(264)
Space and water heating			1044.5219	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	187.3978	0.1443	27.0473	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-393.4414	0.1332	-52.3936	
PV Unit electricity exported	-273.8300	0.1251	-34.2563	
Total			-86.6499	(269)
Total CO2, kg/year			996.8485	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2109.0647	1.1300	2383.2431	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2864.8490	1.1300	3237.2793	(278)
Space and water heating			5620.5225	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	187.3978	1.5338	287.4370	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-393.4414	1.4921	-587.0474	
PV Unit electricity exported	-273.8300	0.4592	-125.7334	
Total			-712.7808	(283)
Total Primary energy kWh/year			5325.2795	(286)
Target Primary Energy Rate (TPER)			65.7400	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 9	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	93 A	**DER**	1.79	**TER**	14.10
Environmental	99 A	**% DER < TER**			87.30
CO_2 Emissions (t/year)	0.09	**DFEE**	26.95	**TFEE**	32.96
Compliance Check	See BREL	**% DFEE < TFEE**			18.24
% DPER < TPER	71.38	**DPER**	21.66	**TPER**	75.66

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0000 (1b)	x	2.6000 (2b)	=	158.6000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			15.6000	0.7752	12.0930			(27)
EXTERNAL	56.1300	17.9400	38.1900	0.1400	5.3466	70.0000	2673.3000	(29a)
External Roof 1	37.4500		37.4500	0.1000	3.7450	9.0000	337.0500	(30)
Total net area of external elements Aum(A, m2)			93.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.0566			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000	180.0000	5902.2000	(32)
Party Floor 1			61.0000			40.0000	2440.0000	(32d)
Party Ceiling 1			23.5500			30.0000	706.5000	(32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12059.0500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							197.6893	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	8.2000	0.3000	2.4600	
E3 Sill	4.0300	0.0400	0.1612	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	26.9500	0.0700	1.8865	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.7800	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	1.4400	0.1200	0.1728	
E14 Flat roof	16.2300	0.0400	0.6492	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.5207 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 30.5773 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.9818	14.7855	14.5892	13.6079	13.4116	12.4303	12.4303	12.2340	12.8228	13.4116	13.8041	14.1967	(38)

Heat transfer coeff

	45.5591	45.3628	45.1665	44.1852	43.9889	43.0076	43.0076	42.8113	43.4001	43.9889	44.3815	44.7740	(39)

Average = Sum(39)m / 12 = 44.1361

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7469	0.7437	0.7404	0.7243	0.7211	0.7050	0.7050	0.7018	0.7115	0.7211	0.7276	0.7340	(40)
HLP (average)												0.7235	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

65.1563	64.1771	62.7503	60.0202	58.0056	55.7588	54.4818	55.8978	57.4501	59.8624	62.6510	64.9066	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 115.2889 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	125.3976	122.7662	119.5355	114.5599	110.5421	106.2135	104.5036	107.7199	111.1185	115.6688	120.7229	125.0633	(44)
Energy conte	198.5991	174.8175	183.7216	156.8267	148.8109	130.6019	126.3880	133.3797	137.0202	156.9614	171.9919	195.8189	(45)

Energy content (annual) Total = Sum(45)m = 1914.9379

Distribution loss (46)m = 0.15 x (45)m

29.7899	26.2226	27.5582	23.5240	22.3216	19.5903	18.9582	20.0070	20.5530	23.5442	25.7988	29.3728	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 1.1340 (55)

Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

257.0155	227.5807	242.1380	213.3587	207.2273	187.1339	184.8044	191.7961	193.5522	215.3778	228.5239	254.2353	(62)
-50.2403	-44.4329	-46.5276	-38.5267	-35.9055	-30.7246	-28.7994	-30.6253	-31.7888	-37.4755	-42.4552	-49.3099	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

206.7752	183.1478	195.6104	174.8321	171.3218	156.4093	156.0050	161.1708	161.7634	177.9023	186.0687	204.9254	(64)

Total per year (kWh/year) = Sum(64)m = 2135.9322 (64)

12Total per year (kWh/year) 2136 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

112.7673	100.3374	107.8206	97.3705	96.2127	88.6507	88.7571	91.0819	90.7848	98.9228	102.4129	111.8429	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

88.4945	97.9760	88.4945	91.4443	88.4945	91.4443	88.4945	88.4945	91.4443	88.4945	91.4443	88.4945	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Pumps, fans

Losses e.g. evaporation (negative values) (Table 5)

-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)

Water heating gains (Table 5)

151.5690	149.3116	144.9201	135.2368	129.3182	123.1260	119.2972	122.4219	126.0900	132.9607	142.2402	150.3265	(72)

Total internal gains

468.6716	477.7165	459.2553	442.7540	421.5555	406.7247	392.2042	393.5081	404.7143	418.4030	442.9623	459.6873	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.5600	10.6334	0.5700	0.7000	0.7700	7.5269	(74)
East	8.5100	19.6403	0.5700	0.7000	0.7700	46.2150	(76)
South	4.5300	46.7521	0.5700	0.7000	0.7700	58.5605	(78)

Solar gains	112.3025	200.6978	295.4975	394.4799	462.8885	467.5045	447.5054	396.1058	330.1684	227.8422	136.3243	94.8815	(83)
Total gains	580.9741	678.4143	754.7528	837.2340	884.4441	874.2292	839.7096	789.6139	734.8828	646.2452	579.2866	554.5688	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.5251	73.8432	74.1641	75.8113	76.1495	77.8871	77.8871	78.2441	77.1826	76.1495	75.4760	74.8143	
alpha	5.9017	5.9229	5.9443	6.0541	6.0766	6.1925	6.1925	6.2163	6.1455	6.0766	6.0317	5.9876	
util living area	0.9430	0.8851	0.7889	0.6226	0.4602	0.3147	0.2253	0.2494	0.4065	0.6802	0.8833	0.9519	(86)
Living	20.7193	20.7678	20.8090	20.8384	20.8455	20.8495	20.8495	20.8501	20.8480	20.8363	20.7846	20.7146	
Non living	19.9586	20.0192	20.0691	20.1148	20.1246	20.1433	20.1433	20.1469	20.1359	20.1162	20.0540	19.9639	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8564	20.7678	20.8090	20.8384	20.8455	20.8495	20.8495	20.8501	20.8480	20.8363	20.7846	20.7545	(87)
Th 2	20.2996	20.3024	20.3053	20.3194	20.3222	20.3364	20.3364	20.3392	20.3307	20.3222	20.3165	20.3109	(88)
util rest of house	0.9327	0.8678	0.7633	0.5912	0.4274	0.2821	0.1914	0.2136	0.3675	0.6425	0.8631	0.9430	(89)
MIT 2	20.1637	20.0192	20.0691	20.1148	20.1246	20.1433	20.1433	20.1469	20.1359	20.1162	20.0540	20.0265	(90)
Living area fraction										fLA = Living area / (4) =		0.4098	(91)
MIT	20.4476	20.3260	20.3723	20.4114	20.4200	20.4327	20.4328	20.4351	20.4278	20.4113	20.3534	20.3248	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4476	20.3260	20.3723	20.4114	20.4200	20.4327	20.4328	20.4351	20.4278	20.4113	20.3534	20.3248	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9351	0.8685	0.7659	0.5955	0.4322	0.2868	0.1963	0.2188	0.3731	0.6476	0.8643	0.9432	(94)
Useful gains	543.2467	589.1788	578.0487	498.5631	382.2259	250.7719	164.8323	172.7372	274.2192	418.5073	500.6519	523.0868	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	735.6689	699.7663	626.5634	508.6317	383.5856	250.8504	164.8378	172.7479	274.6255	431.5908	588.2055	721.9740	(97)
Space heating kWh	143.1621	74.3148	36.0950	7.2494	1.0116	0.0000	0.0000	0.0000	0.0000	9.7341	63.0386	147.9721	(98a)
Space heating requirement - total per year (kWh/year)												482.5777	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	143.1621	74.3148	36.0950	7.2494	1.0116	0.0000	0.0000	0.0000	0.0000	9.7341	63.0386	147.9721	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												482.5777	
Space heating per m2											(98c) / (4) =	7.9111	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 298.4972 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	143.1621	74.3148	36.0950	7.2494	1.0116	0.0000	0.0000	0.0000	0.0000	9.7341	63.0386	147.9721	(98)
Space heating efficiency (main heating system 1)	298.4972	298.4972	298.4972	298.4972	298.4972	0.0000	0.0000	0.0000	0.0000	298.4972	298.4972	298.4972	(210)
Space heating fuel (main heating system)	47.9610	24.8963	12.0922	2.4286	0.3389	0.0000	0.0000	0.0000	0.0000	3.2610	21.1187	49.5723	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	206.7752	183.1478	195.6104	174.8321	171.3218	156.4093	156.0050	161.1708	161.7634	177.9023	186.0687	204.9254	(64)
Efficiency of water heater												463.4856	(216)
(217)m	463.4856	463.4856	463.4856	463.4856	463.4856	463.4856	463.4856	463.4856	463.4856	463.4856	463.4856	463.4856	(217)
Fuel for water heating, kWh/month	44.6131	39.5153	42.2042	37.7211	36.9638	33.7463	33.6591	34.7736	34.9015	38.3836	40.1455	44.2140	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.0252	15.3776	17.0252	16.4760	17.0252	16.4760	17.0252	17.0252	16.4760	17.0252	16.4760	17.0252	(231)
Lighting	21.8087	17.4957	15.7530	11.5413	8.9148	7.2835	8.1324	10.5708	13.7304	18.0151	20.3480	22.4148	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.6740	-16.5620	-29.2171	-39.0759	-47.1270	-45.8805	-45.0307	-39.6716	-30.9078	-20.9197	-11.4001	-7.9488	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9324	-5.2108	-13.6373	-25.7241	-38.5818	-40.5195	-39.3389	-30.4132	-18.7722	-8.5427	-2.8559	-1.4256	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												161.6691	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												463.4856	
Water heating fuel used												460.8412	(219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	200.4577	(230a)
Total electricity for the above, kWh/year	200.4577	(231)
Electricity for lighting (calculated in Appendix L)	176.0085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-570.3696	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	428.6069	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	161.6691	0.1593	25.7559	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	460.8412	0.1405	64.7523	(264)
Space and water heating			90.5082	(265)
Pumps, fans and electric keep-hot	200.4577	0.1387	27.8060	(267)
Energy for lighting	176.0085	0.1443	25.4035	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-343.4152	0.1313	-45.0858	
PV Unit electricity exported	-226.9544	0.1208	-27.4182	
Total			-72.5040	(269)
Total CO2, kg/year			71.2137	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.1700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	161.6691	1.5896	256.9951	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	460.8412	1.5195	700.2628	(278)
Space and water heating			957.2579	(279)
Pumps, fans and electric keep-hot	200.4577	1.5128	303.2524	(281)
Energy for lighting	176.0085	1.5338	269.9678	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-343.4152	1.4850	-509.9804	
PV Unit electricity exported	-226.9544	0.4432	-100.5880	
Total			-610.5684	(283)
Total Primary energy kWh/year			919.9097	(286)
Dwelling Primary energy Rate (DPER)			15.0800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		61.0000	(1b) x	2.6000	(2b) =	158.6000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		158.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3761	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4795	0.4701	0.4607	0.4137	0.4043	0.3573	0.3573	0.3479	0.3761	0.4043	0.4231	0.4419	(22b)
Effective ac	0.6150	0.6105	0.6061	0.5856	0.5817	0.5638	0.5638	0.5605	0.5707	0.5817	0.5895	0.5976	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			12.9100	1.1450	14.7824			(27)
EXTERNAL	56.1300	15.2500	40.8800	0.1800	7.3584			(29a)
External Roof 1	37.4500		37.4500	0.1100	4.1195			(30)
Total net area of external elements Aum(A, m2)			93.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.6003			(33)
Main dwelling								
Party Wall 1			32.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 201.5500 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	8.2000	0.0500	0.4100	
E3 Sill	4.0300	0.0500	0.2015	
E4 Jamb	26.6600	0.0500	1.3330	
E7 Party floor between dwellings (in blocks of flats)	26.9500	0.0700	1.8865	
E16 Corner (normal)	7.8000	0.0900	0.7020	
E17 Corner (inverted - internal area greater than external area)	5.2000	-0.0900	-0.4680	
E18 Party wall between dwellings	10.4000	0.0600	0.6240	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.7800	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	1.4400	0.1200	0.1728	
E14 Flat roof	16.2300	0.0800	1.2984	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.1602 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 34.7605 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.1866	31.9529	31.7239	30.6481	30.4468	29.5098	29.5098	29.3363	29.8707	30.4468	30.8540	31.2797	(38)
Heat transfer coeff													
	66.9471	66.7135	66.4844	65.4086	65.2073	64.2703	64.2703	64.0968	64.6312	65.2073	65.6145	66.0402	(39)
Average = Sum(39)m / 12 =												65.4076	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0975	1.0937	1.0899	1.0723	1.0690	1.0536	1.0536	1.0508	1.0595	1.0690	1.0756	1.0826	(40)
HLP (average)												1.0723	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

57.9167	57.0463	55.7780	53.3513	51.5605	49.5634	48.4282	49.6869	51.0667	53.2110	55.6898	57.6948	(42a)

Hot water usage for baths

25.0293	24.6576	24.1341	23.1690	22.4462	21.6449	21.2120	21.7318	22.2978	23.1553	24.1403	24.9447	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 108.6142 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.1580	115.6354	112.5632	107.8910	104.0970	100.0181	98.4501	101.5090	104.7352	109.0174	113.7617	117.8515	(44)
Energy conte	187.1333	164.6633	173.0055	147.6973	140.1346	122.9839	119.0668	125.6893	129.1490	147.9356	162.0744	184.5269	(45)
Energy content (annual)										Total = Sum(45)m =		1804.0599	
Distribution loss (46)m = 0.15 x (45)m													
	28.0700	24.6995	25.9508	22.1546	21.0202	18.4476	17.8600	18.8534	19.3723	22.1903	24.3112	27.6790	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	238.0594	210.6611	223.9316	196.9806	191.0606	172.2672	169.9929	176.6154	178.4322	198.8617	211.3577	235.4530	(62)
WWHRS	-26.4771	-23.4166	-24.5205	-20.3039	-18.9225	-16.1921	-15.1775	-16.1398	-16.7530	-19.7500	-22.3743	-25.9868	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	211.5823	187.2445	199.4111	176.6767	172.1381	156.0751	154.8153	160.4756	161.6792	179.1117	188.9834	209.4662	(64)
										Total per year (kWh/year) = Sum(64)m =		2157.6593	(64)
12Total per year (kWh/year)												2158	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	102.9627	91.5488	98.2652	88.5360	87.3356	80.3188	80.3306	82.5326	82.3687	89.9294	93.3164	102.0961	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	88.6967	98.1999	88.6967	91.6532	88.6967	91.6532	88.6967	88.6967	91.6532	88.6967	91.6532	88.6967	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)													
	138.3907	136.2333	132.0769	122.9667	117.3866	111.5539	107.9712	110.9309	114.4009	120.8729	129.6061	137.2259	(72)
Total internal gains													
	458.6956	467.8621	449.6143	433.6928	412.8261	395.3615	381.0804	382.2194	393.2342	409.5174	433.5371	449.7889	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1200	10.6334	0.6300	0.7000	0.7700	6.8894	(74)
East	7.0400	19.6403	0.6300	0.7000	0.7700	42.2563	(76)
South	3.7500	46.7521	0.6300	0.7000	0.7700	53.5801	(78)

Solar gains	102.7258	183.5788	270.2838	360.8115	423.3769	427.5977	409.3061	362.2965	301.9929	208.4053	124.6983	86.7910	(83)
Total gains	561.4214	651.4408	719.8981	794.5043	836.2030	822.9592	790.3865	744.5158	695.2271	617.9227	558.2355	536.5800	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.0127	51.1914	51.3677	52.2126	52.3738	53.1373	53.1373	53.2812	52.8406	52.3738	52.0487	51.7132	
alpha	4.4008	4.4128	4.4245	4.4808	4.4916	4.5425	4.5425	4.5521	4.5227	4.4916	4.4699	4.4475	
util living area													
	0.9754	0.9536	0.9125	0.8160	0.6684	0.4889	0.3556	0.3925	0.6077	0.8538	0.9536	0.9792	(86)
MIT	19.8027	20.0486	20.3543	20.6979	20.8997	20.9809	20.9964	20.9944	20.9503	20.6819	20.1992	19.7701	(87)
Th 2	20.0029	20.0060	20.0091	20.0235	20.0263	20.0389	20.0389	20.0412	20.0340	20.0263	20.0208	20.0150	(88)
util rest of house													
	0.9695	0.9431	0.8933	0.7799	0.6132	0.4197	0.2790	0.3124	0.5342	0.8157	0.9413	0.9742	(89)
MIT 2	18.6374	18.9455	19.3209	19.7311	19.9444	20.0276	20.0376	20.0390	20.0011	19.7265	19.1484	18.6053	(90)
Living area fraction									fLA = Living area / (4) =			0.4098	(91)
MIT	19.1150	19.3976	19.7444	20.1273	20.3359	20.4183	20.4305	20.4306	20.3901	20.1181	19.5791	19.0827	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1150	19.3976	19.7444	20.1273	20.3359	20.4183	20.4305	20.4306	20.3901	20.1181	19.5791	19.0827	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9628	0.9353	0.8874	0.7840	0.6314	0.4474	0.3104	0.3452	0.5621	0.8197	0.9345	0.9681	(94)
Useful gains	540.5452	609.2974	638.8550	622.8763	527.9757	368.2024	245.3402	256.9792	390.8150	506.5102	521.6810	519.4382	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	991.8217	967.1849	880.5486	734.3631	563.1265	373.9446	246.1890	258.3465	406.5378	620.6482	818.8087	982.8559	(97)
Space heating kWh													
	335.7497	240.5004	179.8201	80.2705	26.1521	0.0000	0.0000	0.0000	0.0000	84.9186	213.9319	344.7828	(98a)
Space heating requirement - total per year (kWh/year)												1506.1261	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	335.7497	240.5004	179.8201	80.2705	26.1521	0.0000	0.0000	0.0000	0.0000	84.9186	213.9319	344.7828	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1506.1261	
Space heating per m2											(98c) / (4) =	24.6906	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	335.7497	240.5004	179.8201	80.2705	26.1521	0.0000	0.0000	0.0000	0.0000	84.9186	213.9319	344.7828	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	363.7592	260.5638	194.8213	86.9669	28.3338	0.0000	0.0000	0.0000	0.0000	92.0029	231.7789	373.5458	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.5823	187.2445	199.4111	176.6767	172.1381	156.0751	154.8153	160.4756	161.6792	179.1117	188.9834	209.4662	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.0902	84.6222	83.8286	82.4093	80.8811	79.8000	79.8000	79.8000	79.8000	82.4889	84.3386	85.1698	(217)
Fuel for water heating, kWh/month													
	248.6564	221.2712	237.8795	214.3894	212.8285	195.5828	194.0042	201.0973	202.6056	217.1343	224.0771	245.9396	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	18.4294	14.7848	13.3120	9.7530	7.5335	6.1549	6.8723	8.9329	11.6029	15.2236	17.1951	18.9416	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5970	-17.5776	-27.1425	-32.8629	-37.5447	-35.8322	-35.4038	-32.3664	-27.4013	-21.1006	-13.1800	-9.8888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.2890	-7.1381	-14.6058	-22.5661	-30.4636	-30.8340	-30.4649	-25.5000	-18.3139	-10.4026	-4.4526	-2.5844	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1631.7726	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2615.4658	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	148.7360	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.5130	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3979.4614	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1631.7726	0.2100	342.6723	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2615.4658	0.2100	549.2478	(264)
Space and water heating			891.9201	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.7360	0.1443	21.4672	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	0.1331	-40.1803	
PV Unit electricity exported	-200.6150	0.1251	-25.0937	
Total			-65.2740	(269)
Total CO2, kg/year			860.0426	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.1000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1631.7726	1.1300	1843.9031	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2615.4658	1.1300	2955.4763	(278)
Space and water heating			4799.3794	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.7360	1.5338	228.1362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.8979	1.4918	-450.3715	
PV Unit electricity exported	-200.6150	0.4591	-92.1033	
Total			-542.4748	(283)
Total Primary energy kWh/year			4615.1416	(286)
Target Primary Energy Rate (TPER)			75.6600	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 10	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	91 B	**DER**	2.51	**TER**	15.60
Environmental	98 A	**% DER < TER**			83.91
CO_2 Emissions (t/year)	0.11	**DFEE**	30.11	**TFEE**	34.39
Compliance Check	See BREL	**% DFEE < TFEE**			12.45
% DPER < TPER	65.55	**DPER**	28.93	**TPER**	83.98

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000	(1b)	x 2.6000	(2b) =	130.0000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			16.3200	0.7752	12.6512			(27)
EXTERNAL	50.4700	18.6600	31.8100	0.1500	4.7715	70.0000	2226.7000	(29a)
HALLWAY	8.2200		8.2200	0.1400	1.1508	70.0000	575.4000	(29a)
External Roof 1	13.1000		13.1000	0.1100	1.4410	9.0000	117.9000	(30)
Total net area of external elements Aum(A, m2)			71.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.8865			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000	180.0000	2770.2000	(32)
Party Floor 1			50.0000			40.0000	2000.0000	(32d)
Party Ceiling 1			36.9000			30.0000	1107.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8797.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		175.9440 (35)
List of Thermal Bridges		

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	10.3000	0.3000	3.0900	
E3 Sill	6.6300	0.0400	0.2652	
E4 Jamb	22.8600	0.0500	1.1430	
E7 Party floor between dwellings (in blocks of flats)	35.1600	0.0700	2.4612	
E16 Corner (normal)	5.2000	0.0900	0.4680	
E18 Party wall between dwellings	5.2000	0.0600	0.3120	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000	
E14 Flat roof	9.9800	0.0400	0.3992	
P4 Party wall - Roof (insulation at ceiling level)	1.5100	0.1200	0.1812	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.3198	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	30.2063	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.2801	12.1193	11.9584	11.1540	10.9931	10.1887	10.1887	10.0279	10.5105	10.9931	11.3149	11.6366	(38)
Heat transfer coeff	42.4864	42.3255	42.1646	41.3603	41.1994	40.3950	40.3950	40.2341	40.7168	41.1994	41.5211	41.8429	(39)
Average = Sum(39)m / 12 =												41.3200	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8497	0.8465	0.8433	0.8272	0.8240	0.8079	0.8079	0.8047	0.8143	0.8240	0.8304	0.8369	(40)
HLP (average)												0.8264	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											1.6901	(42)
Hot water usage for mixer showers												
	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths												
	23.9204	23.5652	23.0649	22.1425	21.4518	20.6860	20.2723	20.7691	21.3099	22.1294	23.0709	23.8396	(42b)
Hot water usage for other uses												
	33.6193	32.3968	31.1742	29.9517	28.7292	27.5067	27.5067	28.7292	29.9517	31.1742	32.3968	33.6193	(42c)
Average daily hot water use (litres/day)												101.1967	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	110.0967	107.7291	104.8553	100.5083	96.9700	93.1693	91.7255	94.5870	97.6025	101.5904	106.0037	109.8144	(44)
Energy conte	174.3662	153.4047	161.1587	137.5908	130.5403	114.5625	110.9341	117.1185	120.3537	137.8572	151.0218	171.9428	(45)
Energy content (annual)										Total = Sum(45)m =		1680.8514	
Distribution loss (46)m = 0.15 x (45)m													
	26.1549	23.0107	24.1738	20.6386	19.5810	17.1844	16.6401	17.5678	18.0531	20.6786	22.6533	25.7914	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss													
	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage													
	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	232.7826	206.1679	219.5751	194.1228	188.9567	171.0945	169.3505	175.5349	176.8857	196.2736	207.5538	230.3592	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	232.7826	206.1679	219.5751	194.1228	188.9567	171.0945	169.3505	175.5349	176.8857	196.2736	207.5538	230.3592	(64)
										Total per year (kWh/year) = Sum(64)m =		2368.6574	(64)
12Total per year (kWh/year)												2369	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	104.7099	93.2176	100.3184	90.9746	90.1378	83.3176	83.6187	85.6750	85.2432	92.5707	95.4403	103.9041	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.2626	82.2193	74.2626	76.7380	74.2626	76.7380	74.2626	74.2626	76.7380	74.2626	76.7380	74.2626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	140.7391	138.7167	134.8366	126.3535	121.1529	115.7190	112.3907	115.1546	118.3933	124.4229	132.5560	139.6561	(72)
Total internal gains	410.5872	418.0493	402.3624	388.1584	370.1359	357.4532	345.1532	346.3893	355.9535	367.7040	388.6590	403.0078	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.5700	0.7000	0.7700	50.4509	(76)
South	5.9500	46.7521	0.5700	0.7000	0.7700	76.9173	(78)
West	1.0800	19.6403	0.5700	0.7000	0.7700	5.8651	(80)

Solar gains	133.2333	236.1368	341.8922	445.9613	513.2673	513.8328	493.7403	444.0456	378.6321	266.5926	161.3927	112.7752	(83)
Total gains	543.8205	654.1862	744.2546	834.1198	883.4032	871.2860	838.8936	790.4349	734.5856	634.2966	550.0517	515.7830	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.5165	57.7351	57.9554	59.0825	59.3132	60.4943	60.4943	60.7362	60.0162	59.3132	58.8536	58.4010	
alpha	4.8344	4.8490	4.8637	4.9388	4.9542	5.0330	5.0330	5.0491	5.0011	4.9542	4.9236	4.8934	
util living area	0.9181	0.8455	0.7391	0.5798	0.4298	0.2963	0.2118	0.2340	0.3805	0.6408	0.8505	0.9302	(86)
Living	20.6494	20.7116	20.7627	20.7991	20.8098	20.8150	20.8153	20.8159	20.8131	20.7957	20.7285	20.6414	
Non living	19.7861	19.8625	19.9235	19.9764	19.9898	20.0094	20.0095	20.0130	20.0018	19.9768	19.8975	19.7872	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.8206	20.7116	20.7627	20.7991	20.8098	20.8150	20.8153	20.8159	20.8131	20.7957	20.7285	20.6916	(87)
Th 2	20.2104	20.2132	20.2160	20.2298	20.2326	20.2465	20.2465	20.2493	20.2409	20.2326	20.2270	20.2215	(88)
util rest of house	0.9050	0.8252	0.7113	0.5470	0.3954	0.2616	0.1756	0.1959	0.3394	0.6012	0.8274	0.9187	(89)
MIT 2	20.0413	19.8625	19.9235	19.9764	19.9898	20.0094	20.0095	20.0130	20.0018	19.9768	19.8975	19.8655	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	20.4466	20.3041	20.3599	20.4042	20.4162	20.4283	20.4285	20.4305	20.4237	20.4027	20.3296	20.2950	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4466	20.3041	20.3599	20.4042	20.4162	20.4283	20.4285	20.4305	20.4237	20.4027	20.3296	20.2950	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9091	0.8276	0.7166	0.5546	0.4037	0.2699	0.1843	0.2051	0.3493	0.6102	0.8306	0.9199	(94)
Useful gains	494.4053	541.4245	533.2959	462.5679	356.6250	235.1975	154.6281	162.1206	256.5934	387.0458	456.8841	474.4675	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	686.0086	651.9850	584.3970	475.8175	359.1018	235.4346	154.6535	162.1640	257.4788	403.8636	549.3082	673.4625	(97)
Space heating kWh	142.5529	74.2966	38.0192	9.5397	1.8427	0.0000	0.0000	0.0000	0.0000	12.5124	66.5454	148.0523	(98a)
Space heating requirement - total per year (kWh/year)												493.3612	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	142.5529	74.2966	38.0192	9.5397	1.8427	0.0000	0.0000	0.0000	0.0000	12.5124	66.5454	148.0523	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												493.3612	
Space heating per m2											(98c) / (4) =	9.8672	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												289.8236	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	142.5529	74.2966	38.0192	9.5397	1.8427	0.0000	0.0000	0.0000	0.0000	12.5124	66.5454	148.0523	(98)
Space heating efficiency (main heating system 1)	289.8236	289.8236	289.8236	289.8236	289.8236	0.0000	0.0000	0.0000	0.0000	289.8236	289.8236	289.8236	(210)
Space heating fuel (main heating system)	49.1861	25.6351	13.1181	3.2916	0.6358	0.0000	0.0000	0.0000	0.0000	4.3173	22.9606	51.0836	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	232.7826	206.1679	219.5751	194.1228	188.9567	171.0945	169.3505	175.5349	176.8857	196.2736	207.5538	230.3592	(64)
Efficiency of water heater												463.5231	(216)
(217)m	463.5231	463.5231	463.5231	463.5231	463.5231	463.5231	463.5231	463.5231	463.5231	463.5231	463.5231	463.5231	(217)
Fuel for water heating, kWh/month	50.2203	44.4785	47.3709	41.8799	40.7653	36.9118	36.5355	37.8697	38.1611	42.3439	44.7774	49.6975	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.9551	12.6046	13.9551	13.5049	13.9551	13.5049	13.9551	13.9551	13.5049	13.9551	13.5049	13.9551	(231)
Lighting	14.3580	11.5185	10.3711	7.5983	5.8692	4.7952	5.3541	6.9594	9.0396	11.8604	13.3963	14.7570	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.4608	-12.8541	-22.8524	-30.8120	-37.3944	-36.4813	-35.7741	-31.3818	-24.2726	-16.2931	-8.8149	-6.1228	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.3601	-3.6933	-9.7169	-18.4360	-27.7443	-29.1827	-28.3468	-21.8827	-13.4842	-6.0984	-2.0197	-1.0017	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												170.2281	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												463.5231	
Water heating fuel used												511.0118	(219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	164.3096	(230a)
Total electricity for the above, kWh/year	164.3096	(231)
Electricity for lighting (calculated in Appendix L)	115.8772	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-433.4809	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	527.9457	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	170.2281	0.1590	27.0615	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	511.0118	0.1407	71.9228	(264)
Space and water heating			98.9843	(265)
Pumps, fans and electric keep-hot	164.3096	0.1387	22.7918	(267)
Energy for lighting	115.8772	0.1443	16.7247	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-270.5141	0.1312	-35.4810	
PV Unit electricity exported	-162.9668	0.1207	-19.6684	
Total			-55.1493	(269)
Total CO2, kg/year			83.3514	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	170.2281	1.5884	270.3874	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	511.0118	1.5204	776.9524	(278)
Space and water heating			1047.3398	(279)
Pumps, fans and electric keep-hot	164.3096	1.5128	248.5676	(281)
Energy for lighting	115.8772	1.5338	177.7363	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-270.5141	1.4846	-401.5927	
PV Unit electricity exported	-162.9668	0.4428	-72.1553	
Total			-473.7480	(283)
Total Primary energy kWh/year			999.8956	(286)
Dwelling Primary energy Rate (DPER)			20.0000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.0000 (1b)	x	2.6000 (2b)	=	130.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	130.0000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1538	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4038	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.5149	0.5048	0.4947	0.4442	0.4341	0.3837	0.3837	0.3736	0.4038	0.4341	0.4543	0.4745	(22b)
Effective ac	0.6326	0.6274	0.6224	0.5987	0.5942	0.5736	0.5736	0.5698	0.5815	0.5942	0.6032	0.6126	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			10.1500	1.1450	11.6221			(27)
EXTERNAL	50.4700	12.4900	37.9800	0.1800	6.8364			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
External Roof 1	13.1000		13.1000	0.1100	1.4410			(30)
Total net area of external elements Aum(A, m2)			71.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.7191			(33)
Main dwelling								
Party Wall 1			15.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3240 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	10.3000	0.0500	0.5150
E3 Sill	6.6300	0.0500	0.3315
E4 Jamb	22.8600	0.0500	1.1430
E7 Party floor between dwellings (in blocks of flats)	35.1600	0.0700	2.4612
E16 Corner (normal)	5.2000	0.0900	0.4680
E18 Party wall between dwellings	5.2000	0.0600	0.3120
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.8400	0.0000	0.0000
E14 Flat roof	9.9800	0.0800	0.7984
P4 Party wall - Roof (insulation at ceiling level)	1.5100	0.1200	0.1812

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.2103 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 29.9294 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1370	26.9161	26.6997	25.6830	25.4927	24.6072	24.6072	24.4432	24.9483	25.4927	25.8776	26.2799	(38)
Heat transfer coeff													
	57.0664	56.8456	56.6291	55.6124	55.4222	54.5367	54.5367	54.3727	54.8778	55.4222	55.8070	56.2093	(39)
Average = Sum(39)m / 12 =												55.6115	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1413	1.1369	1.1326	1.1122	1.1084	1.0907	1.0907	1.0875	1.0976	1.1084	1.1161	1.1242	(40)
HLP (average)												1.1122	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers

52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6525 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8924 (55)

Total storage loss

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)

If cylinder contains dedicated solar storage

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

220.7358	195.4180	207.9166	183.3084	178.0887	160.8829	158.9709	164.9801	166.4765	185.1667	196.3539	218.3706	(62)
WWHRS -24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
196.7090	174.1685	185.6654	164.8835	160.9173	146.1892	145.1979	150.3339	151.2738	167.2444	176.0502	194.7887	(64)
									Total per year (kWh/year) = Sum(64)m =		2013.4219	(64)
12Total per year (kWh/year)											2013	(64)	

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

97.2026	86.4804	92.9402	83.9900	83.0224	76.5335	76.6658	78.6638	78.3934	85.3759	88.3276	96.4162	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	74.6751	82.6760	74.6751	77.1642	74.6751	77.1642	74.6751	74.6751	77.1642	74.6751	77.1642	74.6751	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	130.6487	128.6911	124.9197	116.6528	111.5893	106.2965	103.0454	105.7310	108.8797	114.7525	122.6772	129.5916	(72)
Total internal gains													
	403.9092	411.4804	395.8579	381.8838	363.9848	348.4570	336.2203	337.3781	346.8660	361.4461	382.2064	396.3558	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7800	19.6403	0.6300	0.7000	0.7700	34.6934	(76)
South	3.7000	46.7521	0.6300	0.7000	0.7700	52.8657	(78)
West	0.6700	19.6403	0.6300	0.7000	0.7700	4.0216	(80)

Solar gains	91.5807	162.3151	235.0124	306.5524	352.8213	353.2112	339.3991	305.2368	260.2684	183.2507	110.9369	77.5182	(83)
Total gains	495.4899	573.7955	630.8703	688.4363	716.8061	701.6682	675.6194	642.6149	607.1345	544.6968	493.1433	473.8740	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6176	44.7910	44.9622	45.7842	45.9413	46.6872	46.6872	46.8280	46.3971	45.9413	45.6245	45.2980	
alpha	3.9745	3.9861	3.9975	4.0523	4.0628	4.1125	4.1125	4.1219	4.0931	4.0628	4.0416	4.0199	
util living area													
	0.9629	0.9357	0.8897	0.7928	0.6539	0.4829	0.3519	0.3843	0.5863	0.8245	0.9350	0.9678	(86)
MIT	19.7045	19.9691	20.2912	20.6517	20.8719	20.9719	20.9939	20.9913	20.9376	20.6508	20.1385	19.6726	(87)
Th 2	19.9672	19.9708	19.9743	19.9908	19.9939	20.0084	20.0084	20.0111	20.0028	19.9939	19.9877	19.9811	(88)
util rest of house													
	0.9549	0.9227	0.8680	0.7557	0.5990	0.4134	0.2741	0.3039	0.5137	0.7839	0.9196	0.9609	(89)
MIT 2	18.4969	18.8265	19.2202	19.6514	19.8872	19.9911	20.0060	20.0074	19.9603	19.6644	19.0541	18.4671	(90)
Living area fraction										fLA = Living area / (4) =		0.5200	(91)
MIT	19.1249	19.4207	19.7771	20.1715	20.3992	20.5011	20.5197	20.5191	20.4685	20.1774	19.6180	19.0940	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1249	19.4207	19.7771	20.1715	20.3992	20.5011	20.5197	20.5191	20.4685	20.1774	19.6180	19.0940	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9469	0.9145	0.8633	0.7628	0.6218	0.4484	0.3145	0.3456	0.5485	0.7920	0.9130	0.9533	(94)
Useful gains	469.1632	524.7385	544.6500	525.1437	445.7312	314.6292	212.4795	222.0625	333.0348	431.3852	450.2364	451.7286	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	846.0014	825.4347	751.8712	626.8375	482.1308	321.8257	213.7699	223.9643	349.4907	530.7977	698.5898	837.1789	(97)
Space heating kWh													
	280.3676	202.0678	154.1726	73.2195	27.0813	0.0000	0.0000	0.0000	0.0000	73.9629	178.8144	286.7750	(98a)
Space heating requirement - total per year (kWh/year)												1276.4611	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	280.3676	202.0678	154.1726	73.2195	27.0813	0.0000	0.0000	0.0000	0.0000	73.9629	178.8144	286.7750	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1276.4611	
Space heating per m2											(98c) / (4) =	25.5292	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	280.3676	202.0678	154.1726	73.2195	27.0813	0.0000	0.0000	0.0000	0.0000	73.9629	178.8144	286.7750	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	303.7569	218.9250	167.0342	79.3277	29.3406	0.0000	0.0000	0.0000	0.0000	80.1331	193.7318	310.6988	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	196.7090	174.1685	185.6654	164.8835	160.9173	146.1892	145.1979	150.3339	151.2738	167.2444	176.0502	194.7887	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.8541	84.3938	83.6460	82.3671	80.9823	79.8000	79.8000	79.8000	79.8000	82.3596	84.0948	84.9257	(217)
Fuel for water heating, kWh/month													
	231.8203	206.3758	221.9656	200.1812	198.7067	183.1945	181.9523	188.3884	189.5662	203.0662	209.3474	229.3636	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	15.5160	12.4475	11.2076	8.2112	6.3425	5.1819	5.7859	7.5207	9.7687	12.8170	14.4768	15.9472	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5527	-14.5050	-22.4402	-27.2267	-31.1635	-29.7715	-29.4238	-26.8758	-22.7130	-17.4432	-10.8680	-8.1434	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.6489	-5.7537	-11.7797	-18.2069	-24.5811	-24.8730	-24.5669	-20.5557	-14.7586	-8.3791	-3.5850	-2.0806	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1382.9481	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2443.9282	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	125.2230	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-411.8959	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3626.2035	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1382.9481	0.2100	290.4191	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2443.9282	0.2100	513.2249	(264)
Space and water heating			803.6440	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	125.2230	0.1443	18.0736	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	0.1330	-33.2786	
PV Unit electricity exported	-161.7692	0.1251	-20.2343	
Total			-53.5130	(269)
Total CO2, kg/year			780.1339	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.6000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1382.9481	1.1300	1562.7314	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2443.9282	1.1300	2761.6388	(278)
Space and water heating			4324.3702	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	125.2230	1.5338	192.0713	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-250.1267	1.4916	-373.0968	
PV Unit electricity exported	-161.7692	0.4591	-74.2677	
Total			-447.3645	(283)
Total Primary energy kWh/year			4199.1778	(286)
Target Primary Energy Rate (TPER)			83.9800	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 11	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	93 A	**DER**	1.38	**TER**	11.90
Environmental	99 A	**% DER < TER**			88.40
CO_2 Emissions (t/year)	0.11	**DFEE**	29.41	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			16.53
% DPER < TPER	72.51	**DPER**	17.42	**TPER**	63.37

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	104.0000 (1b)	x	2.6000 (2b)	=	270.4000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	104.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	270.4000	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			30.4700	0.7752	23.6202			(27)
EXTERNAL	107.7200	32.8100	74.9100	0.1400	10.4874	70.0000	5243.7000	(29a)
HALLWAY	8.2200		8.2200	0.1300	1.0686	70.0000	575.4000	(29a)
External Roof 1	37.7500		37.7500	0.1000	3.7750	9.0000	339.7500	(30)
Total net area of external elements Aum(A, m2)			153.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8232			(33)
Main dwelling								
Party Floor 1			104.0000			40.0000	4160.0000	(32d)
Party Ceiling 1			66.2500			30.0000	1987.5000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12306.3500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	118.3303	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	14.0800	0.3000	4.2240	
E3 Sill	7.8000	0.0400	0.3120	
E4 Jamb	29.9400	0.0500	1.4970	
E7 Party floor between dwellings (in blocks of flats)	63.2200	0.0700	4.4254	
E16 Corner (normal)	10.4000	0.0900	0.9360	
E18 Party wall between dwellings	2.6000	0.0600	0.1560	
E14 Flat roof	25.9400	0.0400	1.0376	
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.3540 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 53.1772 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.5427	25.2080	24.8734	23.2003	22.8657	21.1926	21.1926	20.8580	21.8618	22.8657	23.5349	24.2042	(38)

Heat transfer coeff

	78.7198	78.3852	78.0506	76.3775	76.0429	74.3698	74.3698	74.0351	75.0390	76.0429	76.7121	77.3813	(39)

Average = Sum(39)m / 12 = 76.2938

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7569	0.7537	0.7505	0.7344	0.7312	0.7151	0.7151	0.7119	0.7215	0.7312	0.7376	0.7441	(40)
HLP (average)												0.7336	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7736 (42)

Hot water usage for mixer showers

79.5644	78.3687	76.6263	73.2926	70.8324	68.0889	66.5294	68.2586	70.1541	73.0999	76.5052	79.2596	(42a)

Hot water usage for baths

30.5368	30.0833	29.4447	28.2671	27.3854	26.4077	25.8796	26.5138	27.2043	28.2504	29.4522	30.4336	(42b)

Hot water usage for other uses

43.0344	41.4695	39.9046	38.3398	36.7749	35.2100	35.2100	36.7749	38.3398	39.9046	41.4695	43.0344	(42c)

Average daily hot water use (litres/day) 140.7903 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	153.1356	149.9215	145.9756	139.8995	134.9927	129.7065	127.6190	131.5472	135.6981	141.2549	147.4269	152.7276	(44)
Energy conte	242.5294	213.4863	224.3591	191.5154	181.7261	159.4893	154.3441	162.8829	167.3293	191.6816	210.0367	239.1344	(45)
Energy content (annual)										Total = Sum(45)m =		2338.5147	
Distribution loss (46)m = 0.15 x (45)m													
	36.3794	32.0229	33.6539	28.7273	27.2589	23.9234	23.1516	24.4324	25.0994	28.7522	31.5055	35.8702	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss													
	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage													
	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	300.9458	266.2495	282.7755	248.0474	240.1425	216.0213	212.7605	221.2993	223.8613	250.0980	266.5687	297.5508	(62)
WWHRS	-61.3500	-54.2584	-56.8163	-47.0462	-43.8453	-37.5188	-35.1679	-37.3975	-38.8184	-45.7626	-51.8434	-60.2139	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	239.5958	211.9910	225.9592	201.0013	196.2972	178.5025	177.5926	183.9018	185.0430	204.3355	214.7253	237.3369	(64)
										Total per year (kWh/year) = Sum(64)m =		2456.2821	(64)
12Total per year (kWh/year)												2456	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	127.3741	113.1947	121.3325	108.9045	107.1571	98.2558	98.0525	100.8917	100.8626	110.4673	115.0628	126.2453	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

132.4701	146.6634	132.4701	136.8858	132.4701	136.8858	132.4701	132.4701	136.8858	132.4701	136.8858	132.4701	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Pumps, fans

Losses e.g. evaporation (negative values) (Table 5)

-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)

Water heating gains (Table 5)

171.2018	168.4446	163.0814	151.2562	144.0283	136.4664	131.7910	135.6071	140.0869	148.4775	159.8094	169.6846	(72)

Total internal gains

630.9128	645.0741	618.6499	596.6197	566.5201	546.0278	525.3485	526.4392	542.2025	560.7981	595.0018	617.8073	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5000	10.6334	0.5700	0.7000	0.7700	13.2309	(74)
East	13.8400	19.6403	0.5700	0.7000	0.7700	75.1605	(76)
South	11.7700	46.7521	0.5700	0.7000	0.7700	152.1540	(78)
West	0.3600	19.6403	0.5700	0.7000	0.7700	1.9550	(80)

Solar gains	242.5005	425.3284	608.8236	790.0984	910.8610	913.8620	877.2030	786.8322	672.1846	477.8736	292.8304	205.9211	(83)

Total gains	873.4132	1070.4025	1227.4735	1386.7181	1477.3811	1459.8897	1402.5515	1313.2715	1214.3871	1038.6717	887.8322	823.7284	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4253	43.6107	43.7976	44.7571	44.9540	45.9653	45.9653	46.1731	45.5554	44.9540	44.5618	44.1764	
alpha	3.8950	3.9074	3.9198	3.9838	3.9969	4.0644	4.0644	4.0782	4.0370	3.9969	3.9708	3.9451	
util living area	0.9211	0.8561	0.7632	0.6156	0.4652	0.3237	0.2328	0.2585	0.4184	0.6793	0.8647	0.9324	(86)
Living	20.5056	20.5889	20.6655	20.7317	20.7582	20.7703	20.7717	20.7723	20.7656	20.7249	20.6155	20.4963	
Non living	19.6870	19.7914	19.8855	19.9755	20.0067	20.0337	20.0348	20.0385	20.0234	19.9725	19.8391	19.6863	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.7471	20.5889	20.6655	20.7317	20.7582	20.7703	20.7717	20.7723	20.7656	20.7249	20.6155	20.5668	(87)
Th 2	20.2908	20.2936	20.2964	20.3105	20.3134	20.3275	20.3275	20.3304	20.3219	20.3134	20.3077	20.3021	(88)
util rest of house	0.9115	0.8410	0.7416	0.5877	0.4336	0.2904	0.1974	0.2212	0.3794	0.6468	0.8479	0.9240	(89)
MIT 2	20.0501	19.7914	19.8855	19.9755	20.0067	20.0337	20.0348	20.0385	20.0234	19.9725	19.8391	19.7973	(90)
Living area fraction									fLA = Living area / (4) =			0.2885	(91)
MIT	20.2512	20.0215	20.1105	20.1936	20.2234	20.2462	20.2474	20.2502	20.2375	20.1895	20.0631	20.0192	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2512	20.0215	20.1105	20.1936	20.2234	20.2462	20.2474	20.2502	20.2375	20.1895	20.0631	20.0192	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9109	0.8347	0.7356	0.5829	0.4294	0.2863	0.1932	0.2167	0.3745	0.6407	0.8414	0.9202	(94)
Useful gains	795.5912	893.4514	902.8820	808.2988	634.4117	418.0121	270.9793	284.6086	454.8034	665.4964	747.0186	758.0007	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1255.6721	1185.2998	1062.3087	862.5780	648.1462	419.9050	271.2548	285.0484	460.5524	729.2161	994.4228	1224.1141	(97)
Space heating kWh	342.3002	196.1221	118.6135	39.0810	10.2184	0.0000	0.0000	0.0000	0.0000	47.4075	178.1310	346.7883	(98a)
Space heating requirement - total per year (kWh/year)												1278.6620	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	342.3002	196.1221	118.6135	39.0810	10.2184	0.0000	0.0000	0.0000	0.0000	47.4075	178.1310	346.7883	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1278.6620	
Space heating per m2											(98c) / (4) =	12.2948	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	335.9322	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	342.3002	196.1221	118.6135	39.0810	10.2184	0.0000	0.0000	0.0000	0.0000	47.4075	178.1310	346.7883	(98)
Space heating efficiency (main heating system 1)	335.9322	335.9322	335.9322	335.9322	335.9322	0.0000	0.0000	0.0000	0.0000	335.9322	335.9322	335.9322	(210)
Space heating fuel (main heating system)	101.8956	58.3815	35.3088	11.6336	3.0418	0.0000	0.0000	0.0000	0.0000	14.1122	53.0259	103.2316	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	239.5958	211.9910	225.9592	201.0013	196.2972	178.5025	177.5926	183.9018	185.0430	204.3355	214.7253	237.3369	(64)
Efficiency of water heater												461.8981	(216)
(217)m	461.8981	461.8981	461.8981	461.8981	461.8981	461.8981	461.8981	461.8981	461.8981	461.8981	461.8981	461.8981	(217)
Fuel for water heating, kWh/month	51.8720	45.8956	48.9197	43.5164	42.4979	38.6454	38.4484	39.8144	40.0614	44.2382	46.4876	51.3830	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	29.0265	26.2175	29.0265	28.0902	29.0265	28.0902	29.0265	29.0265	28.0902	29.0265	28.0902	29.0265	(231)
Lighting	35.4793	28.4628	25.6276	18.7759	14.5030	11.8491	13.2301	17.1970	22.3373	29.3077	33.1030	36.4654	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.3503	-27.8062	-48.6065	-64.1043	-76.3297	-73.8526	-72.5063	-64.2335	-50.5125	-34.7874	-19.1991	-13.4454	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4580	-9.3527	-24.5317	-46.4877	-69.9466	-73.6034	-71.4845	-55.3779	-34.2747	-15.4951	-5.1311	-2.5535	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	380.6310	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	461.8981	
Water heating fuel used	531.7800	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	341.7640	(230a)
Total electricity for the above, kWh/year	341.7640	(231)
Electricity for lighting (calculated in Appendix L)	286.3381	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-973.4308	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	567.0822	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	380.6310	0.1581	60.1703	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	531.7800	0.1406	74.7791	(264)
Space and water heating			134.9494	(265)
Pumps, fans and electric keep-hot	341.7640	0.1387	47.4069	(267)
Energy for lighting	286.3381	0.1443	41.3274	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-561.7339	0.1315	-73.8823	
PV Unit electricity exported	-411.6969	0.1207	-49.6910	
Total			-123.5732	(269)
Total CO2, kg/year			100.1105	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.9600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	380.6310	1.5851	603.3478	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	531.7800	1.5199	808.2785	(278)
Space and water heating			1411.6263	(279)
Pumps, fans and electric keep-hot	341.7640	1.5128	517.0205	(281)
Energy for lighting	286.3381	1.5338	439.1949	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-561.7339	1.4859	-834.6943	
PV Unit electricity exported	-411.6969	0.4428	-182.2962	
Total			-1016.9905	(283)
Total Primary energy kWh/year			1350.8512	(286)
Dwelling Primary energy Rate (DPER)			12.9900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	104.0000	(1b) x	2.6000	(2b) =	270.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 104.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		270.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1479	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3979	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3979	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5074	0.4974	0.4875	0.4377	0.4278	0.3780	0.3780	0.3681	0.3979	0.4278	0.4477	0.4676	(22b)
Effective ac	0.6287	0.6237	0.6188	0.5958	0.5915	0.5715	0.5715	0.5677	0.5792	0.5915	0.6002	0.6093	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			23.6600	1.1450	27.0916			(27)
EXTERNAL	107.7200	26.0000	81.7200	0.1800	14.7096			(29a)
HALLWAY	8.2200		8.2200	0.1800	1.4796			(29a)
External Roof 1	37.7500		37.7500	0.1100	4.1525			(30)
Total net area of external elements Aum(A, m2)			153.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.7733			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 124.7005 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	14.0800	0.0500	0.7040
E3 Sill	7.8000	0.0500	0.3900
E4 Jamb	29.9400	0.0500	1.4970
E7 Party floor between dwellings (in blocks of flats)	63.2200	0.0700	4.4254
E16 Corner (normal)	10.4000	0.0900	0.9360
E18 Party wall between dwellings	2.6000	0.0600	0.1560
E14 Flat roof	25.9400	0.0800	2.0752
E17 Corner (inverted - internal area greater than external area)	2.6000	-0.0900	-0.2340

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9496 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.7229 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1008	55.6548	55.2177	53.1644	52.7803	50.9920	50.9920	50.6608	51.6808	52.7803	53.5574	54.3699	(38)
Heat transfer coeff	115.8237	115.3777	114.9406	112.8873	112.5032	110.7149	110.7149	110.3837	111.4037	112.5032	113.2803	114.0928	(39)
Average = Sum(39)m / 12 =												112.8855	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1137	1.1094	1.1052	1.0855	1.0818	1.0646	1.0646	1.0614	1.0712	1.0818	1.0892	1.0970	(40)
HLP (average)												1.0854	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7736 (42)

Hot water usage for mixer showers

70.7239	69.6611	68.1123	65.1490	62.9622	60.5234	59.1373	60.6743	62.3592	64.9777	68.0046	70.4529	(42a)

Hot water usage for baths

30.5368	30.0833	29.4447	28.2671	27.3854	26.4077	25.8796	26.5138	27.2043	28.2504	29.4522	30.4336	(42b)

Hot water usage for other uses

43.0344	41.4695	39.9046	38.3398	36.7749	35.2100	35.2100	36.7749	38.3398	39.9046	41.4695	43.0344	(42c)

Average daily hot water use (litres/day) 132.6397 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.2951	141.2139	137.4616	131.7559	127.1224	122.1411	120.2268	123.9629	127.9032	133.1327	138.9264	143.9209	(44)
Energy conte	228.5282	201.0867	211.2734	180.3672	171.1312	150.1867	145.4039	153.4920	157.7174	180.6599	197.9261	225.3454	(45)
Energy content (annual)											Total = Sum(45)m =	2203.1181	
Distribution loss (46)m = 0.15 x (45)m	34.2792	30.1630	31.6910	27.0551	25.6697	22.5280	21.8106	23.0238	23.6576	27.0990	29.6889	33.8018	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6525 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8924 (55)

Total storage loss

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)

If cylinder contains dedicated solar storage

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)

Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

279.4543	247.0845	262.1994	229.6505	222.0573	199.4700	196.3300	204.4181	207.0007	231.5859	247.2094	276.2715	(62)

WWHRS	-32.3320	-28.5947	-29.9427	-24.7938	-23.1069	-19.7727	-18.5338	-19.7088	-20.4576	-24.1173	-27.3220	-31.7333	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

247.1223	218.4898	232.2567	204.8567	198.9504	179.6973	177.7962	184.7092	186.5431	207.4686	219.8874	244.5382	(64)

Total per year (kWh/year) = Sum(64)m = 2502.3159 (64)

12Total per year (kWh/year) 2502 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

116.7265	103.6595	110.9892	99.3987	97.6420	89.3637	89.0877	91.7769	91.8677	100.8103	105.2371	115.6682	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	138.6799	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.4429	146.6332	132.4429	136.8577	132.4429	136.8577	132.4429	132.4429	136.8577	132.4429	136.8577	132.4429	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	262.6369	265.3622	258.4944	243.8737	225.4177	208.0716	196.4834	193.7580	200.6258	215.2465	233.7026	251.0486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	36.8680	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	-110.9439	(71)
Water heating gains (Table 5)													
	156.8905	154.2552	149.1791	138.0538	131.2392	124.1163	119.7415	123.3561	127.5940	135.4977	146.1626	155.4680	(72)
Total internal gains													
	619.5742	633.8547	607.7204	586.3892	556.7038	533.6495	513.2717	514.1610	529.6815	550.7911	584.3268	606.5635	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.4900	10.6334	0.6300	0.7000	0.7700	11.3415	(74)
East	10.7500	19.6403	0.6300	0.7000	0.7700	64.5249	(76)
South	9.1400	46.7521	0.6300	0.7000	0.7700	130.5927	(78)
West	0.2800	19.6403	0.6300	0.7000	0.7700	1.6806	(80)

Solar gains	208.1397	365.0634	522.5593	678.1439	781.7862	784.3571	752.8952	675.3376	576.9414	410.1639	251.3386	176.7431	(83)
Total gains	827.7139	998.9181	1130.2797	1264.5330	1338.4900	1318.0067	1266.1669	1189.4986	1106.6229	960.9550	835.6654	783.3067	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.1030	31.2232	31.3419	31.9120	32.0209	32.5381	32.5381	32.6358	32.3370	32.0209	31.8013	31.5748	
alpha	3.0735	3.0815	3.0895	3.1275	3.1347	3.1692	3.1692	3.1757	3.1558	3.1347	3.1201	3.1050	
util living area													
	0.9565	0.9258	0.8782	0.7861	0.6583	0.5000	0.3731	0.4100	0.6085	0.8269	0.9298	0.9623	(86)
MIT	19.0279	19.3878	19.8335	20.3525	20.7120	20.9132	20.9741	20.9648	20.8334	20.3456	19.6130	18.9824	(87)
Th 2	19.9897	19.9932	19.9966	20.0127	20.0158	20.0299	20.0299	20.0325	20.0244	20.0158	20.0096	20.0032	(88)
util rest of house													
	0.9494	0.9142	0.8595	0.7547	0.6103	0.4347	0.2953	0.3299	0.5431	0.7937	0.9170	0.9561	(89)
MIT 2	17.7052	18.1565	18.7089	19.3422	19.7505	19.9664	20.0166	20.0134	19.8920	19.3524	18.4562	17.6566	(90)
Living area fraction										fLA = Living area / (4) =		0.2885	(91)
MIT	18.0868	18.5116	19.0333	19.6336	20.0278	20.2395	20.2928	20.2878	20.1635	19.6389	18.7899	18.0390	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0868	18.5116	19.0333	19.6336	20.0278	20.2395	20.2928	20.2878	20.1635	19.6389	18.7899	18.0390	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9314	0.8928	0.8382	0.7413	0.6110	0.4493	0.3168	0.3516	0.5529	0.7792	0.8968	0.9394	(94)
Useful gains	770.9018	891.8680	947.3954	937.4123	817.7666	592.1609	401.0826	418.2274	611.8983	748.7283	749.4078	735.8636	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1596.8366	1570.4808	1440.5868	1211.6892	936.9078	624.3756	408.8501	429.1518	675.4997	1016.9078	1324.2357	1578.9355	(97)
Space heating kWh													
	614.4955	456.0279	366.9344	197.4794	88.6410	0.0000	0.0000	0.0000	0.0000	199.5256	413.8761	627.2455	(98a)
Space heating requirement - total per year (kWh/year)												2964.2253	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	614.4955	456.0279	366.9344	197.4794	88.6410	0.0000	0.0000	0.0000	0.0000	199.5256	413.8761	627.2455	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2964.2253	
Space heating per m2											(98c) / (4) =	28.5022	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	614.4955	456.0279	366.9344	197.4794	88.6410	0.0000	0.0000	0.0000	0.0000	199.5256	413.8761	627.2455	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	665.7589	494.0713	397.5454	213.9538	96.0358	0.0000	0.0000	0.0000	0.0000	216.1707	448.4032	679.5726	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.1223	218.4898	232.2567	204.8567	198.9504	179.6973	177.7962	184.7092	186.5431	207.4686	219.8874	244.5382	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0176	85.6703	85.0806	83.9776	82.3732	79.8000	79.8000	79.8000	79.8000	83.9723	85.4561	86.0769	(217)
Fuel for water heating, kWh/month													
	287.2928	255.0357	272.9843	243.9422	241.5232	225.1846	222.8022	231.4652	233.7633	247.0679	257.3104	284.0927	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	27.5190	22.0768	19.8777	14.5633	11.2491	9.1906	10.2618	13.3387	17.3256	22.7321	25.6759	28.2839	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.3586	-29.1164	-44.6094	-53.5582	-60.7608	-57.8006	-57.0753	-52.3660	-44.6319	-34.7316	-21.9134	-16.5294	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-6.0208	-13.0217	-26.5680	-40.9436	-55.1878	-55.8598	-55.2254	-46.2916	-33.3089	-18.9788	-8.1487	-4.7365 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3211.5117	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3002.4645	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	222.0943	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-856.7434	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5665.3271	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3211.5117	0.2100	674.4175	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3002.4645	0.2100	630.5176	(264)
Space and water heating			1304.9350	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	222.0943	0.1443	32.0551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.4518	0.1333	-65.6268	
PV Unit electricity exported	-364.2917	0.1251	-45.5875	
Total			-111.2143	(269)
Total CO2, kg/year			1237.7050	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3211.5117	1.1300	3629.0082	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3002.4645	1.1300	3392.7849	(278)
Space and water heating			7021.7932	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	222.0943	1.5338	340.6556	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-492.4518	1.4925	-734.9602	
PV Unit electricity exported	-364.2917	0.4593	-167.3237	
Total			-902.2839	(283)
Total Primary energy kWh/year			6590.2656	(286)
Target Primary Energy Rate (TPER)			63.3700	(287)

Full SAP Calculation Printout

Property Reference	13 Bedford Road REV C	**Issued on Date**	21/02/2025
Assessment Reference	Be Green - Flat 12	**Prop Type Ref**	13 Bedford Road
Property	Flat 1, 13 Bedford Road, LONDON, N22 7AU		

SAP Rating	91 B	**DER**	2.27	**TER**	16.34
Environmental	98 A	**% DER < TER**			86.11
CO_2 Emissions (t/year)	0.12	**DFEE**	38.93	**TFEE**	44.47
Compliance Check	See BREL	**% DFEE < TFEE**			12.48
% DPER < TPER	69.73	**DPER**	26.54	**TPER**	87.65

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	64.0000 (1b)	x	2.6000 (2b)	=	166.4000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	166.4000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2862	0.2825	0.2787	0.2600	0.2562	0.2375	0.2375	0.2337	0.2450	0.2562	0.2637	0.2712	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
ENTRANCE DOOR			2.3400	0.8000	1.8720			(26)
WINDOWS			22.4300	0.7752	17.3876			(27)
EXTERNAL	91.8700	24.7700	67.1000	0.1400	9.3940	70.0000	4697.0000	(29a)
HALLWAY	9.7700		9.7700	0.1300	1.2701	70.0000	683.9000	(29a)
External Roof 1	64.0000		64.0000	0.1000	6.4000	9.0000	576.0000	(30)
Total net area of external elements Aum(A, m2)			165.6400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3237			(33)
Main dwelling								
Party Floor 1			64.0000			40.0000	2560.0000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8516.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		133.0766 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.4000	0.3000	3.7200

E3 Sill	3.8000	0.0400	0.1520	
E4 Jamb	29.0400	0.0500	1.4520	
E7 Party floor between dwellings (in blocks of flats)	36.3000	0.0700	2.5410	
E16 Corner (normal)	14.0000	0.0900	1.2600	
E18 Party wall between dwellings	2.8000	0.0600	0.1680	
E14 Flat roof	36.3000	0.0400	1.4520	
E17 Corner (inverted - internal area greater than external area)	2.8000	-0.0900	-0.2520	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.4930	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	46.8167	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.7186	15.5126	15.3067	14.2771	14.0712	13.0416	13.0416	12.8357	13.4534	14.0712	14.4830	14.8949	(38)
Heat transfer coeff	62.5353	62.3293	62.1234	61.0938	60.8879	59.8583	59.8583	59.6524	60.2701	60.8879	61.2997	61.7116	(39)
Average = Sum(39)m / 12 =												61.0423	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9771	0.9739	0.9707	0.9546	0.9514	0.9353	0.9353	0.9321	0.9417	0.9514	0.9578	0.9642	(40)
HLP (average)												0.9538	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0922	(42)
Hot water usage for mixer showers	66.7109	65.7084	64.2475	61.4524	59.3896	57.0892	55.7817	57.2315	58.8208	61.2907	64.1459	66.4553	(42a)
Hot water usage for baths	25.6236	25.2430	24.7071	23.7191	22.9792	22.1588	21.7157	22.2478	22.8272	23.7051	24.7135	25.5369	(42b)
Hot water usage for other uses	36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)
Average daily hot water use (litres/day)												118.0405	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.3905	125.6963	122.3884	117.2941	113.1803	108.7484	106.9978	110.2909	113.7707	118.4296	123.6043	128.0483	(44)
Energy conte	203.3392	178.9899	188.1064	160.5697	152.3624	133.7189	129.4045	136.5631	140.2906	160.7078	176.0970	200.4927	(45)
Energy content (annual)										Total = Sum(45)m =		1960.6423	
Distribution loss (46)m = 0.15 x (45)m	30.5009	26.8485	28.2160	24.0855	22.8544	20.0578	19.4107	20.4845	21.0436	24.1062	26.4145	30.0739	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.7556	231.7531	246.5228	217.1017	210.7788	190.2509	187.8209	194.9795	196.8226	219.1242	232.6290	258.9091	(62)
WWHRS	-51.4390	-45.4931	-47.6378	-39.4459	-36.7622	-31.4577	-29.4866	-31.3560	-32.5473	-38.3697	-43.4682	-50.4865	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	210.3166	186.2600	198.8851	177.6557	174.0166	158.7932	158.3344	163.6235	164.2753	180.7545	189.1608	208.4226	(64)
										Total per year (kWh/year) = Sum(64)m =		2170.4983	(64)
12Total per year (kWh/year)												2170	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	114.3434	101.7247	109.2785	98.6150	97.3936	89.6871	89.7601	92.1404	91.8722	100.1685	103.7778	113.3969	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.2575	102.1422	92.2575	95.3327	92.2575	95.3327	92.2575	92.2575	95.3327	92.2575	95.3327	92.2575	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)	153.6874	151.3760	146.8797	136.9653	130.9054	124.5655	120.6453	123.8446	127.6003	134.6350	144.1359	152.4152	(72)
Total internal gains	483.2383	492.7097	473.5457	456.5241	434.5354	419.1902	404.1244	405.4256	417.0396	431.1815	456.6111	473.8957	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.3600	10.6334	0.5700	0.7000	0.7700	1.0585	(74)
East	16.9500	19.6403	0.5700	0.7000	0.7700	92.0499	(76)
West	5.1200	19.6403	0.5700	0.7000	0.7700	27.8050	(80)

Solar gains	120.9134	236.4844	389.5621	568.6612	697.5867	714.4526	680.0414	583.6578	453.2119	280.6163	150.7507	99.4452	(83)
Total gains	604.1517	729.1941	863.1078	1025.1853	1132.1222	1133.6428	1084.1657	989.0833	870.2514	711.7978	607.3618	573.3409	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.8315	37.9565	38.0823	38.7241	38.8551	39.5234	39.5234	39.6599	39.2534	38.8551	38.5941	38.3365	
alpha	3.5221	3.5304	3.5388	3.5816	3.5903	3.6349	3.6349	3.6440	3.6169	3.5903	3.5729	3.5558	
util living area													
	0.9330	0.8842	0.7960	0.6408	0.4785	0.3336	0.2419	0.2756	0.4600	0.7343	0.8912	0.9417	(86)
Living	20.4015	20.4871	20.5891	20.6839	20.7252	20.7421	20.7448	20.7449	20.7334	20.6646	20.5226	20.3912	
Non living	19.3794	19.4868	19.6113	19.7325	19.7784	19.8087	19.8108	19.8140	19.7958	19.7173	19.5453	19.3768	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6938	20.4871	20.5891	20.6839	20.7252	20.7421	20.7448	20.7449	20.7334	20.6646	20.5226	20.4764	(87)
Th 2	20.1024	20.1051	20.1078	20.1213	20.1241	20.1376	20.1376	20.1403	20.1322	20.1241	20.1186	20.1132	(88)
util rest of house													
	0.9230	0.8685	0.7715	0.6064	0.4382	0.2900	0.1949	0.2248	0.4072	0.6961	0.8737	0.9328	(89)
MIT 2	19.8142	19.4868	19.6113	19.7325	19.7784	19.8087	19.8108	19.8140	19.7958	19.7173	19.5453	19.5095	(90)
Living area fraction										fLA = Living area / (4) =		0.4062	(91)
MIT	20.1715	19.8932	20.0085	20.1190	20.1631	20.1879	20.1902	20.1922	20.1767	20.1021	19.9423	19.9023	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1715	19.8932	20.0085	20.1190	20.1631	20.1879	20.1902	20.1922	20.1767	20.1021	19.9423	19.9023	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9238	0.8644	0.7686	0.6063	0.4401	0.2926	0.1978	0.2279	0.4100	0.6950	0.8698	0.9305	(94)
Useful gains	558.1333	630.3380	663.3835	621.6104	498.2022	331.6824	214.4231	225.4045	356.8005	494.7232	528.2859	533.4660	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	992.5306	934.5143	839.1967	685.4108	515.2984	334.4826	214.9036	226.2125	366.2439	578.5633	787.2316	969.0129	(97)
Space heating kWh													
	323.1916	204.4065	130.8050	45.9363	12.7195	0.0000	0.0000	0.0000	0.0000	62.3771	186.4409	324.0469	(98a)
Space heating requirement - total per year (kWh/year)												1289.9237	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	323.1916	204.4065	130.8050	45.9363	12.7195	0.0000	0.0000	0.0000	0.0000	62.3771	186.4409	324.0469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1289.9237	
Space heating per m2											(98c) / (4) =	20.1551	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 329.3734 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	323.1916	204.4065	130.8050	45.9363	12.7195	0.0000	0.0000	0.0000	0.0000	62.3771	186.4409	324.0469	(98)
Space heating efficiency (main heating system 1)													
	329.3734	329.3734	329.3734	329.3734	329.3734	0.0000	0.0000	0.0000	0.0000	329.3734	329.3734	329.3734	(210)
Space heating fuel (main heating system)													
	98.1232	62.0592	39.7133	13.9466	3.8617	0.0000	0.0000	0.0000	0.0000	18.9381	56.6047	98.3828	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.3166	186.2600	198.8851	177.6557	174.0166	158.7932	158.3344	163.6235	164.2753	180.7545	189.1608	208.4226	(64)
Efficiency of water heater												463.3331	(216)
(217)m	463.3331	463.3331	463.3331	463.3331	463.3331	463.3331	463.3331	463.3331	463.3331	463.3331	463.3331	463.3331	(217)
Fuel for water heating, kWh/month													
	45.3921	40.2000	42.9249	38.3430	37.5576	34.2719	34.1729	35.3145	35.4551	39.0118	40.8261	44.9833	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	17.8625	16.1339	17.8625	17.2863	17.8625	17.2863	17.8625	17.8625	17.2863	17.8625	17.2863	17.8625	(231)
Lighting	22.9597	18.4192	16.5844	12.1504	9.3854	7.6679	8.5616	11.1287	14.4551	18.9659	21.4219	23.5979	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.2945	-17.6823	-31.1930	-41.4418	-49.6140	-48.0833	-47.1932	-41.5971	-32.4348	-22.1983	-12.1390	-8.4497	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.9309	-5.2517	-13.9469	-26.8142	-40.6659	-42.9247	-41.6761	-32.2255	-19.8948	-8.8354	-2.8773	-1.4247	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 391.6296 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 463.3331

Water heating fuel used 468.4531 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0360)		
mechanical ventilation fans (SFP = 1.0360)	210.3163	(230a)
Total electricity for the above, kWh/year	210.3163	(231)
Electricity for lighting (calculated in Appendix L)	185.2982	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-600.7893	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	654.9079	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	391.6296	0.1575	61.6631	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	468.4531	0.1405	65.8283	(264)
Space and water heating			127.4913	(265)
Pumps, fans and electric keep-hot	210.3163	0.1387	29.1735	(267)
Energy for lighting	185.2982	0.1443	26.7443	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.3210	0.1314	-47.6085	
PV Unit electricity exported	-238.4683	0.1204	-28.7213	
Total			-76.3299	(269)
Total CO2, kg/year			107.0792	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	391.6296	1.5828	619.8838	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	468.4531	1.5196	711.8533	(278)
Space and water heating			1331.7371	(279)
Pumps, fans and electric keep-hot	210.3163	1.5128	318.1665	(281)
Energy for lighting	185.2982	1.5338	284.2166	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-362.3210	1.4854	-538.2095	
PV Unit electricity exported	-238.4683	0.4418	-105.3629	
Total			-643.5724	(283)
Total Primary energy kWh/year			1290.5478	(286)
Dwelling Primary energy Rate (DPER)			20.1600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	64.0000	(1b) x	2.6000	(2b) =	166.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 64.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		166.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1202	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3702	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3702	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)

Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4720	0.4627	0.4535	0.4072	0.3980	0.3517	0.3517	0.3424	0.3702	0.3980	0.4165	0.4350	(22b)
Effective ac	0.6114	0.6071	0.6028	0.5829	0.5792	0.5618	0.5618	0.5586	0.5685	0.5792	0.5867	0.5946	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			2.3400	1.0000	2.3400			(26)
TER Opening Type			13.6600	1.1450	15.6412			(27)
EXTERNAL	91.8700	16.0000	75.8700	0.1800	13.6566			(29a)
HALLWAY	9.7700		9.7700	0.1800	1.7586			(29a)
External Roof 1	64.0000		64.0000	0.1100	7.0400			(30)
Total net area of external elements Aum(A, m2)			165.6400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.4364			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 133.0766 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.4000	0.0500	0.6200
E3 Sill	3.8000	0.0500	0.1900
E4 Jamb	29.0400	0.0500	1.4520
E7 Party floor between dwellings (in blocks of flats)	36.3000	0.0700	2.5410
E16 Corner (normal)	14.0000	0.0900	1.2600
E18 Party wall between dwellings	2.8000	0.0600	0.1680
E14 Flat roof	36.3000	0.0800	2.9040
E17 Corner (inverted - internal area greater than external area)	2.8000	-0.0900	-0.2520

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.8830 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 49.3194 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.5726	33.3351	33.1023	32.0088	31.8042	30.8518	30.8518	30.6754	31.2186	31.8042	32.2181	32.6508	(38)
Heat transfer coeff	82.8921	82.6545	82.4217	81.3282	81.1236	80.1712	80.1712	79.9948	80.5381	81.1236	81.5375	81.9702	(39)
Average = Sum(39)m / 12 =												81.3272	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2952	1.2915	1.2878	1.2708	1.2676	1.2527	1.2527	1.2499	1.2584	1.2676	1.2740	1.2808	(40)
HLP (average)												1.2707	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0922 (42)

Hot water usage for mixer showers

59.2986	58.4075	57.1089	54.6243	52.7908	50.7460	49.5837	50.8725	52.2852	54.4806	57.0186	59.0714	(42a)

Hot water usage for baths

25.6236	25.2430	24.7071	23.7191	22.9792	22.1588	21.7157	22.2478	22.8272	23.7051	24.7135	25.5369	(42b)

Hot water usage for other uses

36.0560	34.7449	33.4338	32.1226	30.8115	29.5004	29.5004	30.8115	32.1226	33.4338	34.7449	36.0560	(42c)

Average daily hot water use (litres/day) 111.2066 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	120.9782	118.3954	115.2498	110.4660	106.5815	102.4052	100.7998	103.9318	107.2350	111.6195	116.4770	120.6644	(44)
Energy conte	191.5999	168.5935	177.1346	151.2224	143.4791	125.9191	121.9086	128.6893	132.2315	151.4666	165.9428	188.9313	(45)
Energy content (annual)										Total = Sum(45)m =		1847.1187	
Distribution loss (46)m = 0.15 x (45)m	28.7400	25.2890	26.5702	22.6834	21.5219	18.8879	18.2863	19.3034	19.8347	22.7200	24.8914	28.3397	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	242.5260	214.5912	228.0607	200.5057	194.4052	175.2024	172.8347	179.6154	181.5148	202.3926	215.2261	239.8573	(62)
WWHRS	-27.1088	-23.9753	-25.1055	-20.7884	-19.3740	-16.5785	-15.5397	-16.5249	-17.1527	-20.2212	-22.9082	-26.6068	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	215.4171	190.6159	202.9552	179.7174	175.0312	158.6239	157.2950	163.0905	164.3621	182.1714	192.3179	213.2505	(64)
										Total per year (kWh/year) = Sum(64)m =		2194.8481	(64)
12Total per year (kWh/year)												2195	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	104.4478	92.8555	99.6381	89.7081	88.4477	81.2947	81.2755	83.5300	83.3936	91.1035	94.6026	103.5605	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	104.6091	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.4146	102.3162	92.4146	95.4951	92.4146	95.4951	92.4146	92.4146	95.4951	92.4146	95.4951	92.4146	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.9108	184.8088	180.0258	169.8433	156.9898	144.9093	136.8388	134.9408	139.7238	149.9062	162.7598	174.8402	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	33.4609	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	-83.6873	(71)
Water heating gains (Table 5)													
	140.3869	138.1779	133.9222	124.5946	118.8813	112.9094	109.2412	112.2716	115.8245	122.4509	131.3925	139.1942	(72)
Total internal gains													
	473.0950	482.6856	463.7454	447.3158	425.6685	407.6966	392.8774	394.0097	405.4261	422.1545	447.0301	463.8318	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.2200	10.6334	0.6300	0.7000	0.7700	0.7149	(74)
East	10.3200	19.6403	0.6300	0.7000	0.7700	61.9439	(76)
West	3.1200	19.6403	0.6300	0.7000	0.7700	18.7272	(80)

Solar gains	81.3861	159.1762	262.2121	382.7639	469.5449	480.8981	457.7356	392.8586	305.0548	188.8812	101.4694	66.9361	(83)
Total gains	554.4811	641.8618	725.9575	830.0797	895.2133	888.5947	850.6130	786.8684	710.4809	611.0357	548.4996	530.7679	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.5408	28.6228	28.7037	29.0896	29.1630	29.5094	29.5094	29.5745	29.3750	29.1630	29.0149	28.8618	
alpha	2.9027	2.9082	2.9136	2.9393	2.9442	2.9673	2.9673	2.9716	2.9583	2.9442	2.9343	2.9241	
util living area													
	0.9567	0.9341	0.8929	0.8057	0.6796	0.5235	0.3963	0.4403	0.6497	0.8518	0.9349	0.9613	(86)
MIT	18.8223	19.1332	19.6023	20.1905	20.6245	20.8763	20.9597	20.9444	20.7575	20.1694	19.4079	18.7801	(87)
Th 2	19.8446	19.8475	19.8504	19.8638	19.8663	19.8781	19.8781	19.8803	19.8736	19.8663	19.8612	19.8559	(88)
util rest of house													
	0.9488	0.9225	0.8740	0.7722	0.6259	0.4471	0.3024	0.3432	0.5751	0.8179	0.9214	0.9542	(89)
MIT 2	17.3494	17.7397	18.3225	19.0378	19.5295	19.7924	19.8595	19.8526	19.6872	19.0354	18.0996	17.3032	(90)
Living area fraction										fLA = Living area / (4) =		0.4062	(91)
MIT	17.9477	18.3058	18.8424	19.5061	19.9744	20.2327	20.3064	20.2962	20.1220	19.4961	18.6311	17.9032	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9477	18.3058	18.8424	19.5061	19.9744	20.2327	20.3064	20.2962	20.1220	19.4961	18.6311	17.9032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9314	0.9025	0.8538	0.7603	0.6314	0.4722	0.3391	0.3804	0.5928	0.8048	0.9026	0.9378	(94)
Useful gains	516.4498	579.2606	619.8301	631.1020	565.2589	419.5989	288.4843	299.3536	421.1688	491.7909	495.0859	497.7587	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1131.2890	1108.0483	1017.2820	862.5732	671.2456	451.5815	297.1488	311.6729	484.9999	721.6798	940.2156	1123.2556	(97)
Space heating kWh													
	457.4403	355.3454	295.7042	166.6593	78.8541	0.0000	0.0000	0.0000	0.0000	171.0373	320.4934	465.3697	(98a)
Space heating requirement - total per year (kWh/year)												2310.9036	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	457.4403	355.3454	295.7042	166.6593	78.8541	0.0000	0.0000	0.0000	0.0000	171.0373	320.4934	465.3697	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2310.9036	
Space heating per m2											(98c) / (4) =	36.1079	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	457.4403	355.3454	295.7042	166.6593	78.8541	0.0000	0.0000	0.0000	0.0000	171.0373	320.4934	465.3697	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	495.6016	384.9896	320.3729	180.5626	85.4324	0.0000	0.0000	0.0000	0.0000	185.3058	347.2301	504.1925	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	215.4171	190.6159	202.9552	179.7174	175.0312	158.6239	157.2950	163.0905	164.3621	182.1714	192.3179	213.2505	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.7054	85.4358	84.9028	83.8910	82.3936	79.8000	79.8000	79.8000	79.8000	83.9186	85.1965	85.7606	(217)
Fuel for water heating, kWh/month													
	251.3460	223.1100	239.0443	214.2273	212.4329	198.7768	197.1115	204.3740	205.9675	217.0812	225.7345	248.6579	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	19.2019	15.4045	13.8701	10.1618	7.8493	6.4129	7.1604	9.3073	12.0893	15.8618	17.9158	19.7356	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.1522	-18.4106	-28.4154	-34.3859	-39.2668	-37.4668	-37.0165	-33.8482	-28.6683	-22.0910	-13.8073	-10.3630	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.4659	-7.5205	-15.3861	-23.7691	-32.0862	-32.4781	-32.0916	-26.8641	-19.2952	-10.9615	-4.6925	-2.7237	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2503.6876	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2637.8641	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	154.9706	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-527.2267	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4855.2956	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2503.6876	0.2100	525.7744	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2637.8641	0.2100	553.9515	(264)
Space and water heating			1079.7259	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	154.9706	0.1443	22.3671	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-315.8921	0.1331	-42.0463	
PV Unit electricity exported	-211.3346	0.1251	-26.4348	
Total			-68.4811	(269)
Total CO2, kg/year			1045.5410	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.3400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2503.6876	1.1300	2829.1670	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2637.8641	1.1300	2980.7864	(278)
Space and water heating			5809.9534	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	154.9706	1.5338	237.6991	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-315.8921	1.4918	-471.2612	
PV Unit electricity exported	-211.3346	0.4591	-97.0257	
Total			-568.2869	(283)
Total Primary energy kWh/year			5609.4664	(286)
Target Primary Energy Rate (TPER)			87.6500	(287)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Shop 1, 13 Bedford Road

As built

Date: Tue Oct 29 09:29:21 2024

Administrative information

Building Details

Address: 13 Bedford Road, Wood Green, LONDON, N22 7AU

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 139.02

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	4.85	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	2.83	
Target primary energy rate (TPER), $kWh/m^2.annum$	52.43	
Building primary energy rate (BPER), $kWh/m^2.annum$	30.43	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF/01 SHOP/East/Wall-External
Floors	0.18	0.13	0.15	GF/02 TOILETS/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.11	0.11	GF/01 SHOP/Roof
Windows** and roof windows	1.6	0.8	0.8	GF/01 SHOP/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Air Con

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.5	6.5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
GF/02 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF/01 SHOP	233	80	1.875
GF/02 TOILETS	601	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF/01 SHOP	YES (+13.4%)	NO
GF/02 TOILETS	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	139	139
External area [m^2]	343.6	343.6
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	66.08	123.88
Average U-value [W/m^2K]	0.19	0.36
Alpha value* [%]	35.72	20.88

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	5.31	10.5
Cooling	11.98	8.44
Auxiliary	0.32	0.43
Lighting	12.52	14.36
Hot water	1.65	1.65
Equipment*	20.24	20.24
TOTAL**	**31.79**	**35.39**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	11.87	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*11.87*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	261.35	233.52
Primary energy [kWh/m^2]	30.43	52.43
Total emissions [kg/m^2]	2.83	4.85

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	62.4	199	5.3	12	0.3	3.26	4.62	3.5	6.5
	Notional	99.8	133.7	10.5	8.4	0.4	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Shop 2, 13 Bedford Road

As built

Date: Tue Oct 29 09:28:34 2024

Administrative information

Building Details

Address: 13 Bedford Road, Wood Green, LONDON, N22 7AU

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 119.35

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	5.3	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	2.7	
Target primary energy rate (TPER), $kWh/m^2.annum$	56.91	
Building primary energy rate (BPER), $kWh/m^2.annum$	28.55	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF/01 SHOP/East/Wall-External
Floors	0.18	0.13	0.15	GF/02 TOILETS/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.11	0.11	GF/01 SHOP/Roof
Windows** and roof windows	1.6	0.8	0.8	GF/01 SHOP/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	8

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Air Con

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	6.5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
GF/02 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF/01 SHOP	233	80	1.875
GF/02 TOILETS	599	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF/01 SHOP	YES (+34%)	NO
GF/02 TOILETS	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	119.4	119.4
External area [m^2]	353.3	353.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	8	3
Average conductance [W/K]	62.13	103.91
Average U-value [W/m^2K]	0.18	0.29
Alpha value* [%]	27.83	17.92

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	6.98	12.78
Cooling	10.83	6.79
Auxiliary	0.38	0.5
Lighting	12.53	16.56
Hot water	1.65	1.65
Equipment*	20.23	20.23
TOTAL**	**32.36**	**38.28**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	13.82	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*13.82*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	261.85	229.07
Primary energy [kWh/m^2]	28.55	56.91
Total emissions [kg/m^2]	2.7	5.3

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	81.9	179.9	7	10.8	0.4	3.26	4.62	3.5	6.5
	Notional	121.5	107.6	12.8	6.8	0.5	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

2. Full Overheating Calculations

Assessment Criteria - CIBSE TM52 (Commercial)

The following tables demonstrate the model baseline without active cooling – with all passive measures maximised:

Table 18: LWC_2020

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (%)	Pass/Fail
Ground Floor	Shop 1	1.80	5.00	2.42	**Pass**
	WC	0.90	1.00	0.65	**Pass**
Ground Floor	Shop 2	1.85	5.05	2.50	**Pass**
	WC	0.90	1.00	0.65	**Pass**
Ground Floor	Corridor	0.00	0.00	0.00	**Pass**

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	**Compliance**
% of spaces pass	**100**	**100**	**100**	**Pass**
% of spaces fail	**0**	**0**	**0**	

Table 19: LWC_2050

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (%)	Pass/Fail
Ground Floor	Shop 1	2.45	5.62	2.85	**Pass**
	WC	1.00	1.58	0.72	**Pass**
Ground Floor	Shop 2	2.55	5.69	2.88	**Pass**
	WC	1.10	1.58	0.72	**Pass**
Ground Floor	Corridor	0.00	0.00	0.00	**Pass**

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	**Compliance**
% of spaces pass	**100**	**100**	**100**	**Pass**
% of spaces fail	**0**	**0**	**0**	

Table 20: LWC_2080

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (hr)	Pass/Fail
Ground Floor	Shop 1	3.05	6.00	3.04	**Fail**
	WC	1.55	1.80	1.00	**Pass**
Ground Floor	Shop 2	3.10	6.05	3.08	**Fail**
	WC	1.55	1.80	1.00	**Pass**
Ground Floor	Corridor	0.00	0.00	0.00	**Pass**

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	**Compliance**
% of spaces pass	**80**	**80**	**80**	**No**
% of spaces fail	**2**	**2**	**2**	

The following tables demonstrate results after considering the proposed ventilation strategy:

Table 21: LWC_2020

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (%)	Pass/Fail
Ground Floor	Shop 1	0.60	4.45	1.12	**Pass**
	WC	0.48	0.90	0.33	**Pass**
Ground Floor	Shop 2	0.69	4.45	1.15	**Pass**
	WC	0.48	0.90	0.33	**Pass**
Ground Floor	Corridor	0.00	0.00	0.00	**Pass**

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	**Compliance**
% of spaces pass	**100**	**100**	**100**	**Pass**
% of spaces fail	**0**	**0**	**0**	

Table 22: LWC_2050

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (%)	Pass/Fail
Ground Floor	Shop 1	0.80	4.63	1.62	**Pass**
	WC	0.65	1.10	0.55	**Pass**
Ground Floor	Shop 2	0.75	4.65	1.65	**Pass**
	WC	0.54	1.10	0.55	**Pass**
Ground Floor	Corridor	0.00	0.00	0.00	**Pass**

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	**Compliance**
% of spaces pass	**100**	**100**	**100**	**Pass**
% of spaces fail	**0**	**0**	**0**	

Table 23: LWC_2080

Block	Zone	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 3 (hr)	Pass/Fail
Ground Floor	Shop 1	0.93	5.22	1.87	**Pass**
	WC	0.74	1.64	0.68	**Pass**
Ground Floor	Shop 2	0.88	5.28	1.90	**Pass**
	WC	0.67	1.70	0.72	**Pass**
Ground Floor	Corridor	0.00	0.00	0.00	**Pass**

Room Name	Criteria 1 ≤3.0%	Criteria 2 We≤6	Criteria 3 ΔT ≤4	**Compliance**
% of spaces pass	**100**	**100**	**100**	**Pass**
% of spaces fail	**0**	**0**	**0**	

ASSESSMENT CRITERIA - CIBSE TM59 & TM49 (RESIDENTIAL)

Scenario 1: Unconstrained Windows (Baseline Scenario - DSY1 2020s)

- Openable windows with no constraints.
- Passive mitigation measures applied to achieve compliance. Such as: brise soleil, **low g-value** glazing (solar control glass) to minimize heat entry, **energy-efficient lighting (LEDs)** to minimize heat from artificial lighting, - **low-energy appliances** to reduce internal heat sources.

Table 24: Summary of Results for Dining/living rooms and kitchens (Criteria A)

Flat Num.	Room Name	**Criteria A** (During The Period May to September)	**TM59 Criteria met ?**
Dining/Living Room, kitchen and bedrooms			
First Floor			
Flat 1	**Kitchen/Living**	1.40	**Pass**
	Bedroom 1	1.18	**Pass**
	Bedroom 2	1.15	**Pass**
Flat 2	**Kitchen/Living**	1.73	**Pass**
	Bedroom 1	1.25	**Pass**
Flat 3	**Kitchen/Living**	1.60	**Pass**
Flat 4	**Kitchen/Living**	1.30	**Pass**
	Bedroom 1	1.25	**Pass**
	Bedroom 2	1.44	**Pass**
	Bedroom 3	1.30	**Pass**
Second Floor			
Flat 5	**Kitchen/Living**	1.78	**Pass**
	Bedroom 1	1.44	**Pass**
	Bedroom 2	1.42	**Pass**
Flat 6	**Kitchen/Living**	1.90	**Pass**
	Bedroom 1	1.30	**Pass**
Flat 3	**Bedroom 1**	1.45	**Pass**
	Bedroom 2	1.45	**Pass**
Flat 7	**Kitchen/Living**	1.60	**Pass**
	Bedroom 1	1.44	**Pass**
	Bedroom 2	1.58	**Pass**
	Bedroom 3	1.50	**Pass**
Third Floor			
Flat 8	**Kitchen/Living**	1.91	**Pass**
	Bedroom 1	1.50	**Pass**
	Bedroom 2	1.50	**Pass**
Flat 9	**Kitchen/Living**	2.10	**Pass**
	Bedroom 1	1.54	**Pass**
Flat 10	**Kitchen/Living**	1.67	**Pass**
	Bedroom 1	1.60	**Pass**
	Bedroom 2	1.55	**Pass**
	Bedroom 3	1.50	**Pass**
Fourth Floor			
Flat 11	**Kitchen/Living**	2.30	**Pass**

	Bedroom 1	2.58	**Pass**
	Bedroom 2	2.60	**Pass**
Flat 12	**Kitchen/Living**	2.98	**Pass**
	Bedroom 1	2.55	**Pass**
	Bedroom 2	2.56	**Pass**

Table 25: Summary of Results for Bedrooms (Criteria B)

Flat Num.	**Room Name**	**Criteria B** 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours.	**TM59 Criteria met ?**
Bedrooms			
First Floor			
Flat 1	**Bedroom 1**	0.35	**Pass**
	Bedroom 2	0.30	**Pass**
Flat 2	**Bedroom 1**	0.28	**Pass**
Flat 4	**Bedroom 1**	0.31	**Pass**
	Bedroom 2	0.40	**Pass**
	Bedroom 3	0.41	**Pass**
Second Floor			
Flat 5	**Bedroom 1**	0.46	**Pass**
	Bedroom 2	0.44	**Pass**
Flat 6	**Bedroom 1**	0.51	**Pass**
Flat 3	**Bedroom 1**	0.51	**Pass**
	Bedroom 2	0.51	**Pass**
Flat 7	**Bedroom 1**	0.49	**Pass**
	Bedroom 2	0.46	**Pass**
	Bedroom 3	0.44	**Pass**
Third Floor			
Flat 8	**Bedroom 1**	0.62	**Pass**
	Bedroom 2	0.67	**Pass**
Flat 9	**Bedroom 1**	0.69	**Pass**
Flat 10	**Bedroom 1**	0.69	**Pass**
	Bedroom 2	0.69	**Pass**
	Bedroom 3	0.70	**Pass**
Fourth Floor			
Flat 11	**Bedroom 1**	0.80	**Pass**
	Bedroom 2	0.85	**Pass**
Flat 12	**Bedroom 1**	0.88	**Pass**
	Bedroom 2	0.90	**Pass**

Scenario 2: Policy-Compliant (Constrained) Scenario – DSY1 2020s

Assumptions:

- Bedroom windows closed at night per noise mitigation requirements.
- Background ventilation only in Living/Kitchen/Dining (LKD) areas.

Table 26: Summary of Results for Dining/living rooms and kitchens (Criteria A)

Flat Num.	Room Name	Criteria A (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room, kitchen and bedrooms			
First Floor			
Flat 1	**Kitchen/Living**	3.25	**No**
	Bedroom 1	3.20	**No**
	Bedroom 2	3.25	**No**
Flat 2	**Kitchen/Living**	3.44	**No**
	Bedroom 1	3.45	**No**
Flat 3	**Kitchen/Living**	3.50	**No**
Flat 4	**Kitchen/Living**	3.22	**No**
	Bedroom 1	3.35	**No**
	Bedroom 2	3.55	**No**
	Bedroom 3	3.68	**No**
Second Floor			
Flat 5	**Kitchen/Living**	3.52	**No**
	Bedroom 1	3.77	**No**
	Bedroom 2	3.78	**No**
Flat 6	**Kitchen/Living**	3.76	**No**
	Bedroom 1	3.80	**No**
Flat 3	**Bedroom 1**	3.88	**No**
	Bedroom 2	3.89	**No**
Flat 7	**Kitchen/Living**	3.30	**No**
	Bedroom 1	3.93	**No**
	Bedroom 2	3.98	**No**
	Bedroom 3	3.95	**No**
Third Floor			
Flat 8	**Kitchen/Living**	3.66	**No**
	Bedroom 1	4.01	**No**
	Bedroom 2	4.05	**No**
Flat 9	**Kitchen/Living**	3.95	**No**
	Bedroom 1	3.05	**No**
Flat 10	**Kitchen/Living**	3.60	**No**
	Bedroom 1	4.33	**No**
	Bedroom 2	4.35	**No**
	Bedroom 3	4.35	**No**
Fourth Floor			
Flat 11	**Kitchen/Living**	3.25	**No**
	Bedroom 1	4.50	**No**
	Bedroom 2	4.56	**No**
Flat 12	**Kitchen/Living**	3.95	**No**
	Bedroom 1	4.77	**No**
	Bedroom 2	4.76	**No**

Table 27: Summary of Results for Bedrooms (Criteria B)

Flat Num.	Room Name	**Criteria B** 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours.	TM59 Criteria met ?
Bedrooms			
First Floor			
Flat 1	**Bedroom 1**	1.25	**No**
	Bedroom 2	1.20	**No**
Flat 2	**Bedroom 1**	1.23	**No**
Flat 4	**Bedroom 1**	1.31	**No**
	Bedroom 2	1.38	**No**
	Bedroom 3	1.30	**No**
Second Floor			
Flat 5	**Bedroom 1**	1.44	**No**
	Bedroom 2	1.43	**No**
Flat 6	**Bedroom 1**	1.50	**No**
Flat 3	**Bedroom 1**	1.50	**No**
	Bedroom 2	1.50	**No**
Flat 7	**Bedroom 1**	1.48	**No**
	Bedroom 2	1.45	**No**
	Bedroom 3	1.42	**No**
Third Floor			
Flat 8	**Bedroom 1**	1.80	**No**
	Bedroom 2	1.85	**No**
Flat 9	**Bedroom 1**	1.97	**No**
Flat 10	**Bedroom 1**	1.97	**No**
	Bedroom 2	1.97	**No**
	Bedroom 3	1.90	**No**
Fourth Floor			
Flat 11	**Bedroom 1**	2.30	**No**
	Bedroom 2	2.25	**No**
Flat 12	**Bedroom 1**	2.28	**No**
	Bedroom 2	2.30	**No**

Mitigation Strategy (Cooling Hierarchy Applied in Order) – DSY2020a

- **External shading** (brise soleil).

Table 28: Summary of Results for Dining/living rooms and kitchens (Criteria A)

Flat Num.	Room Name	**Criteria A** (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room, kitchen and bedrooms			
First Floor			
Flat 1	**Kitchen/Living**	3.05	**No**
	Bedroom 1	3.08	**No**
	Bedroom 2	3.08	**No**
Flat 2	**Kitchen/Living**	3.10	**No**
	Bedroom 1	3.12	**No**
Flat 3	**Kitchen/Living**	3.15	**No**
Flat 4	**Kitchen/Living**	3.00	**No**
	Bedroom 1	3.05	**No**
	Bedroom 2	3.15	**No**
	Bedroom 3	3.18	**No**
Second Floor			
Flat 5	**Kitchen/Living**	3.18	**No**
	Bedroom 1	3.10	**No**
	Bedroom 2	3.10	**No**
Flat 6	**Kitchen/Living**	3.11	**No**
	Bedroom 1	3.20	**No**
Flat 3	**Bedroom 1**	3.28	**No**
	Bedroom 2	3.28	**No**
Flat 7	**Kitchen/Living**	3.00	**No**
	Bedroom 1	3.33	**No**
	Bedroom 2	3.38	**No**
	Bedroom 3	3.38	**No**
Third Floor			
Flat 8	**Kitchen/Living**	3.26	**No**
	Bedroom 1	3.61	**No**
	Bedroom 2	3.85	**No**
Flat 9	**Kitchen/Living**	3.55	**No**
	Bedroom 1	3.00	**No**
Flat 10	**Kitchen/Living**	3.30	**No**
	Bedroom 1	4.00	**No**
	Bedroom 2	4.01	**No**
	Bedroom 3	4.05	**No**
Fourth Floor			
Flat 11	**Kitchen/Living**	3.00	**No**
	Bedroom 1	4.21	**No**
	Bedroom 2	4.26	**No**
Flat 12	**Kitchen/Living**	3.56	**No**
	Bedroom 1	4.37	**No**
	Bedroom 2	4.36	**No**

Table 29: Summary of Results for Bedrooms (Criteria B)

Flat Num.	Room Name	**Criteria B** 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours.	TM59 Criteria met ?
Bedrooms			
First Floor			
Flat 1	**Bedroom 1**	1.15	**No**
	Bedroom 2	1.12	**No**
Flat 2	**Bedroom 1**	1.13	**No**
Flat 4	**Bedroom 1**	1.21	**No**
	Bedroom 2	1.23	**No**
	Bedroom 3	1.24	**No**
Second Floor			
Flat 5	**Bedroom 1**	1.22	**No**
	Bedroom 2	1.21	**No**
Flat 6	**Bedroom 1**	1.27	**No**
Flat 3	**Bedroom 1**	1.27	**No**
	Bedroom 2	1.27	**No**
Flat 7	**Bedroom 1**	1.31	**No**
	Bedroom 2	1.32	**No**
	Bedroom 3	1.30	**No**
Third Floor			
Flat 8	**Bedroom 1**	1.67	**No**
	Bedroom 2	1.68	**No**
Flat 9	**Bedroom 1**	1.75	**No**
Flat 10	**Bedroom 1**	1.75	**No**
	Bedroom 2	1.77	**No**
	Bedroom 3	1.78	**No**
Fourth Floor			
Flat 11	**Bedroom 1**	2.10	**No**
	Bedroom 2	2.05	**No**
Flat 12	**Bedroom 1**	2.08	**No**
	Bedroom 2	2.10	**No**

Mitigation Strategy (Cooling Hierarchy Applied in Order) – DSY2020a

- **Mechanical Cooling**

Table 30: Summary of Results for Dining/living rooms and kitchens (Criteria A)

Flat Num.	Room Name	**Criteria A** (During The Period May to September)	**TM59 Criteria met ?**
Dining/Living Room, kitchen and bedrooms			
First Floor			
Flat 1	**Kitchen/Living**	1.00	**Pass**
	Bedroom 1	0.80	**Pass**
	Bedroom 2	0.80	**Pass**
Flat 2	**Kitchen/Living**	1.05	**Pass**
	Bedroom 1	1.07	**Pass**
Flat 3	**Kitchen/Living**	1.09	**Pass**
Flat 4	**Kitchen/Living**	1.10	**Pass**
	Bedroom 1	1.11	**Pass**
	Bedroom 2	1.13	**Pass**
	Bedroom 3	1.15	**Pass**
Second Floor			
Flat 5	**Kitchen/Living**	1.20	**Pass**
	Bedroom 1	1.25	**Pass**
	Bedroom 2	1.25	**Pass**
Flat 6	**Kitchen/Living**	1.23	**Pass**
	Bedroom 1	1.20	**Pass**
Flat 3	**Bedroom 1**	1.18	**Pass**
	Bedroom 2	1.18	**Pass**
Flat 7	**Kitchen/Living**	1.25	**Pass**
	Bedroom 1	1.33	**Pass**
	Bedroom 2	1.33	**Pass**
	Bedroom 3	1.35	**Pass**
Third Floor			
Flat 8	**Kitchen/Living**	1.32	**Pass**
	Bedroom 1	1.41	**Pass**
	Bedroom 2	1.45	**Pass**
Flat 9	**Kitchen/Living**	1.50	**Pass**
	Bedroom 1	1.20	**Pass**
Flat 10	**Kitchen/Living**	1.35	**Pass**
	Bedroom 1	1.45	**Pass**
	Bedroom 2	1.50	**Pass**
	Bedroom 3	1.50	**Pass**
Fourth Floor			
Flat 11	**Kitchen/Living**	1.35	**Pass**
	Bedroom 1	1.62	**Pass**
	Bedroom 2	1.66	**Pass**
Flat 12	**Kitchen/Living**	1.45	**Pass**
	Bedroom 1	1.70	**Pass**
	Bedroom 2	1.77	**Pass**

Table 31: Summary of Results for Bedrooms (Criteria B)

Flat Num.	Room Name	**Criteria B** 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours.	TM59 Criteria met ?
Bedrooms			
First Floor			
Flat 1	**Bedroom 1**	0.30	**Pass**
	Bedroom 2	0.32	**Pass**
Flat 2	**Bedroom 1**	0.33	**Pass**
Flat 4	**Bedroom 1**	0.32	**Pass**
	Bedroom 2	0.32	**Pass**
	Bedroom 3	0.35	**Pass**
Second Floor			
Flat 5	**Bedroom 1**	0.38	**Pass**
	Bedroom 2	0.40	**Pass**
Flat 6	**Bedroom 1**	0.41	**Pass**
Flat 3	**Bedroom 1**	0.41	**Pass**
	Bedroom 2	0.41	**Pass**
Flat 7	**Bedroom 1**	0.40	**Pass**
	Bedroom 2	0.39	**Pass**
	Bedroom 3	0.39	**Pass**
Third Floor			
Flat 8	**Bedroom 1**	0.44	**Pass**
	Bedroom 2	0.48	**Pass**
Flat 9	**Bedroom 1**	0.50	**Pass**
Flat 10	**Bedroom 1**	0.50	**Pass**
	Bedroom 2	0.52	**Pass**
	Bedroom 3	0.58	**Pass**
Fourth Floor			
Flat 11	**Bedroom 1**	0.55	**Pass**
	Bedroom 2	0.56	**Pass**
Flat 12	**Bedroom 1**	0.58	**Pass**
	Bedroom 2	0.60	**Pass**

Scenario 3: Future Climate Resilience (DSY2, DSY3 2020s & DSY1 2050s)

- Assessment of future overheating risk using TM49 extreme weather files.

Several design features are implemented to minimise cooling requirement and improve thermal comfort to the occupants:

- Optimum glazing ratio balancing solar gains for daylighting and reducing cooling loads;
- Internal blinds fully covering the windowpanes for the residential accommodation;
- Natural ventilation through openable windows, wherever possible.
- The floor to ceiling height has been maximised, wherever possible to properly accommodate for building services.
- Natural ventilation is possible through openable windows within the residential areas. Cross ventilation is facilitated in dual aspect flats, wherever possible. **However, due to high external noise levels, the potential for natural ventilation can be limited, therefore, mechanical ventilation is provided.**
- High efficiency mechanical background ventilation combined with the heat pump is proposed for fresh air supply all year around.
- A limited level of comfort cooling is proposed to the residential areas for future proofing to cope with climate uncertainty as well as to mitigate noise issues on site. However, passive measures have been applied to all spaces to minimise cooling demand.

Summary of Results DSY2 2020s

Table 32: Summary of Results for Dining/living rooms and kitchens (Criteria A)

Flat Num.	Room Name	Criteria A (During The Period May to September)	TM59 Criteria met ?
Dining/Living Room, kitchen and bedrooms			
First Floor			
Flat 1	**Kitchen/Living**	0.35	**Pass**
	Bedroom 1	0.20	**Pass**
	Bedroom 2	0.18	**Pass**
Flat 2	**Kitchen/Living**	0.65	**Pass**
	Bedroom 1	0.20	**Pass**
Flat 3	**Kitchen/Living**	0.51	**Pass**
Flat 4	**Kitchen/Living**	0.25	**Pass**
	Bedroom 1	0.20	**Pass**
	Bedroom 2	0.33	**Pass**
	Bedroom 3	0.30	**Pass**
Second Floor			
Flat 5	**Kitchen/Living**	0.48	**Pass**
	Bedroom 1	0.24	**Pass**
	Bedroom 2	0.22	**Pass**
Flat 6	**Kitchen/Living**	0.73	**Pass**
	Bedroom 1	0.24	**Pass**
Flat 3	**Bedroom 1**	0.30	**Pass**
	Bedroom 2	0.30	**Pass**
Flat 7	**Kitchen/Living**	0.45	**Pass**
	Bedroom 1	0.33	**Pass**
	Bedroom 2	0.40	**Pass**
	Bedroom 3	0.38	**Pass**

Third Floor			
Flat 8	**Kitchen/Living**	0.61	**Pass**
	Bedroom 1	0.32	**Pass**
	Bedroom 2	0.30	**Pass**
Flat 9	**Kitchen/Living**	0.91	**Pass**
	Bedroom 1	0.32	**Pass**
Flat 10	**Kitchen/Living**	0.54	**Pass**
	Bedroom 1	0.42	**Pass**
	Bedroom 2	0.40	**Pass**
	Bedroom 3	0.40	**Pass**
Fourth Floor			
Flat 11	**Kitchen/Living**	0.82	**Pass**
	Bedroom 1	0.38	**Pass**
	Bedroom 2	0.40	**Pass**
Flat 12	**Kitchen/Living**	0.92	**Pass**
	Bedroom 1	0.45	**Pass**
	Bedroom 2	0.46	**Pass**

Table 33: Summary of Results for Bedrooms (Criteria B)

Flat Num.	**Room Name**	**Criteria B** 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours.	**TM59 Criteria met ?**
Bedrooms			
First Floor			
Flat 1	**Bedroom 1**	0.21	**Pass**
	Bedroom 2	0.15	**Pass**
Flat 2	**Bedroom 1**	0.18	**Pass**
Flat 4	**Bedroom 1**	0.21	**Pass**
	Bedroom 2	0.17	**Pass**
	Bedroom 3	0.20	**Pass**
Second Floor			
Flat 5	**Bedroom 1**	0.22	**Pass**
	Bedroom 2	0.23	**Pass**
Flat 6	**Bedroom 1**	0.25	**Pass**
Flat 3	**Bedroom 1**	0.25	**Pass**
	Bedroom 2	0.25	**Pass**
Flat 7	**Bedroom 1**	0.22	**Pass**
	Bedroom 2	0.23	**Pass**
	Bedroom 3	0.29	**Pass**
Third Floor			
Flat 8	**Bedroom 1**	0.26	**Pass**
	Bedroom 2	0.24	**Pass**
Flat 9	**Bedroom 1**	0.27	**Pass**
Flat 10	**Bedroom 1**	0.27	**Pass**
	Bedroom 2	0.27	**Pass**
	Bedroom 3	0.26	**Pass**
Fourth Floor			
Flat 11	**Bedroom 1**	0.31	**Pass**
	Bedroom 2	0.32	**Pass**
Flat 12	**Bedroom 1**	0.32	**Pass**
	Bedroom 2	0.31	**Pass**

Summary of Results DSY3 2020s

Table 34: Summary of Results for Dining/living rooms and kitchens (Criteria A)

Flat Num.	Room Name	**Criteria A** (During The Period May to September)	**TM59 Criteria met ?**
Dining/Living Room, kitchen and bedrooms			
First Floor			
Flat 1	**Kitchen/Living**	0.50	**Pass**
	Bedroom 1	0.24	**Pass**
	Bedroom 2	0.22	**Pass**
Flat 2	**Kitchen/Living**	0.85	**Pass**
	Bedroom 1	0.24	**Pass**
Flat 3	**Kitchen/Living**	0.85	**Pass**
Flat 4	**Kitchen/Living**	0.50	**Pass**
	Bedroom 1	0.24	**Pass**
	Bedroom 2	0.36	**Pass**
	Bedroom 3	0.34	**Pass**
Second Floor			
Flat 5	**Kitchen/Living**	0.57	**Pass**
	Bedroom 1	0.30	**Pass**
	Bedroom 2	0.28	**Pass**
Flat 6	**Kitchen/Living**	0.92	**Pass**
	Bedroom 1	0.30	**Pass**
Flat 3	**Bedroom 1**	0.30	**Pass**
	Bedroom 2	0.30	**Pass**
Flat 7	**Kitchen/Living**	0.58	**Pass**
	Bedroom 1	0.40	**Pass**
	Bedroom 2	0.47	**Pass**
	Bedroom 3	0.44	**Pass**
Third Floor			
Flat 8	**Kitchen/Living**	0.80	**Pass**
	Bedroom 1	0.38	**Pass**
	Bedroom 2	0.35	**Pass**
Flat 9	**Kitchen/Living**	1.80	**Pass**
	Bedroom 1	0.40	**Pass**
Flat 10	**Kitchen/Living**	0.77	**Pass**
	Bedroom 1	0.45	**Pass**
	Bedroom 2	0.48	**Pass**
	Bedroom 3	0.53	**Pass**
Fourth Floor			
Flat 11	**Kitchen/Living**	1.20	**Pass**
	Bedroom 1	0.48	**Pass**
	Bedroom 2	0.50	**Pass**
Flat 12	**Kitchen/Living**	1.47	**Pass**
	Bedroom 1	0.54	**Pass**
	Bedroom 2	0.50	**Pass**

Table 35: Summary of Results for Bedrooms (Criteria B)

Flat Num.	Room Name	**Criteria B** 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours.	TM59 Criteria met ?
Bedrooms			
First Floor			
Flat 1	**Bedroom 1**	0.28	**Pass**
	Bedroom 2	0.21	**Pass**
Flat 2	**Bedroom 1**	0.24	**Pass**
Flat 4	**Bedroom 1**	0.25	**Pass**
	Bedroom 2	0.23	**Pass**
	Bedroom 3	0.26	**Pass**
Second Floor			
Flat 5	**Bedroom 1**	0.32	**Pass**
	Bedroom 2	0.25	**Pass**
Flat 6	**Bedroom 1**	0.30	**Pass**
Flat 3	**Bedroom 1**	0.30	**Pass**
	Bedroom 2	0.30	**Pass**
Flat 7	**Bedroom 1**	0.32	**Pass**
	Bedroom 2	0.28	**Pass**
	Bedroom 3	0.32	**Pass**
Third Floor			
Flat 8	**Bedroom 1**	0.38	**Pass**
	Bedroom 2	0.30	**Pass**
Flat 9	**Bedroom 1**	0.38	**Pass**
Flat 10	**Bedroom 1**	0.40	**Pass**
	Bedroom 2	0.33	**Pass**
	Bedroom 3	0.41	**Pass**
Fourth Floor			
Flat 11	**Bedroom 1**	0.50	**Pass**
	Bedroom 2	0.48	**Pass**
Flat 12	**Bedroom 1**	0.50	**Pass**
	Bedroom 2	0.47	**Pass**

Summary of Results DSY1 2050s

Table 36: Summary of Results for Dining/living rooms and kitchens (Criteria A)

Flat Num.	Room Name	**Criteria A** (During The Period May to September)	**TM59 Criteria met ?**
Dining/Living Room, kitchen and bedrooms			
First Floor			
Flat 1	**Kitchen/Living**	0.73	**Pass**
	Bedroom 1	0.36	**Pass**
	Bedroom 2	0.34	**Pass**
Flat 2	**Kitchen/Living**	1.04	**Pass**
	Bedroom 1	0.37	**Pass**
Flat 3	**Kitchen/Living**	1.04	**Pass**
Flat 4	**Kitchen/Living**	0.73	**Pass**
	Bedroom 1	0.40	**Pass**
	Bedroom 2	0.49	**Pass**
	Bedroom 3	0.46	**Pass**
Second Floor			
Flat 5	**Kitchen/Living**	1.10	**Pass**
	Bedroom 1	0.40	**Pass**
	Bedroom 2	0.39	**Pass**
Flat 6	**Kitchen/Living**	1.15	**Pass**
	Bedroom 1	0.42	**Pass**
Flat 3	**Bedroom 1**	0.48	**Pass**
	Bedroom 2	0.48	**Pass**
Flat 7	**Kitchen/Living**	1.10	**Pass**
	Bedroom 1	0.52	**Pass**
	Bedroom 2	0.59	**Pass**
	Bedroom 3	0.55	**Pass**
Third Floor			
Flat 8	**Kitchen/Living**	1.25	**Pass**
	Bedroom 1	0.56	**Pass**
	Bedroom 2	0.53	**Pass**
Flat 9	**Kitchen/Living**	1.65	**Pass**
	Bedroom 1	0.58	**Pass**
Flat 10	**Kitchen/Living**	1.20	**Pass**
	Bedroom 1	0.65	**Pass**
	Bedroom 2	0.69	**Pass**
	Bedroom 3	0.70	**Pass**
Fourth Floor			
Flat 11	**Kitchen/Living**	1.75	**Pass**
	Bedroom 1	0.69	**Pass**
	Bedroom 2	0.71	**Pass**
Flat 12	**Kitchen/Living**	2.20	**Pass**
	Bedroom 1	0.76	**Pass**
	Bedroom 2	0.77	**Pass**

Table 37: Summary of Results for Bedrooms (Criteria B)

Flat Num.	Room Name	**Criteria B** 10:00pm to 7:00am shall not exceed 26°C for more than 1% of annual hours.	TM59 Criteria met ?
Bedrooms			
First Floor			
Flat 1	**Bedroom 1**	0.29	**Pass**
	Bedroom 2	0.23	**Pass**
Flat 2	**Bedroom 1**	0.27	**Pass**
Flat 4	**Bedroom 1**	0.29	**Pass**
	Bedroom 2	0.28	**Pass**
	Bedroom 3	0.30	**Pass**
Second Floor			
Flat 5	**Bedroom 1**	0.35	**Pass**
	Bedroom 2	0.30	**Pass**
Flat 6	**Bedroom 1**	0.34	**Pass**
Flat 3	**Bedroom 1**	0.35	**Pass**
	Bedroom 2	0.36	**Pass**
Flat 7	**Bedroom 1**	0.36	**Pass**
	Bedroom 2	0.33	**Pass**
	Bedroom 3	0.38	**Pass**
Third Floor			
Flat 8	**Bedroom 1**	0.47	**Pass**
	Bedroom 2	0.39	**Pass**
Flat 9	**Bedroom 1**	0.44	**Pass**
Flat 10	**Bedroom 1**	0.46	**Pass**
	Bedroom 2	0.44	**Pass**
	Bedroom 3	0.50	**Pass**
Fourth Floor			
Flat 11	**Bedroom 1**	0.57	**Pass**
	Bedroom 2	0.52	**Pass**
Flat 12	**Bedroom 1**	0.55	**Pass**
	Bedroom 2	0.55	**Pass**