



EAL CONSULT BUILDING SUSTAINABILITY SINCE 2008

ENERGY & SUSTAINABILITY ASSESSMENT

DAISY COURT

PROPERTY ADDRESS

**DAISY COURT
6 BROWNLOW ROAD
LONDON
N11 2DE**

DATE

February 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 an additional floor on the top of the existing Daisy Court to provide two new residential units in Bounds Green.

Strategy

The strategy highlights how the proposed development will promote sustainability throughout both design and operation and responds to the UK Planning and regulatory framework, National Planning Policy Framework 2023, the London Plan 2021 and Haringey's Local Plan Strategic Policies, 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 permeability 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 Solar Photovoltaic Panels have been proposed for the specific scheme and will deliver a further **74%** reduction in regulated carbon emissions over Part L 2021 baseline

Energy Efficiency & Carbon Reduction

- This report demonstrates that the proposed development by incorporating the measures above can achieve an **overall** carbon emission reduction of **99%**

Overheating

The development proposal will minimise adverse impacts on the urban heat island through design, layout, orientation and materials.

Ventilation

The development utilises natural ventilation in the building.

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

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.

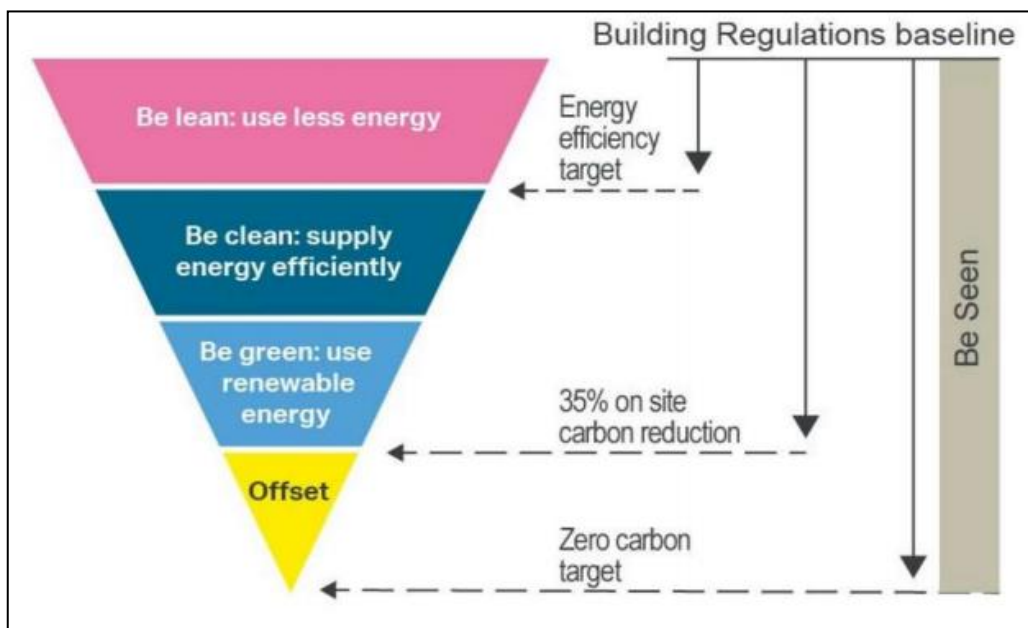
2.METHODOLOGY

This energy assessment outlines the energy demand from the development together with the associated CO₂ 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 CO₂ 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 software (2021) has been used to determine the CO₂ emissions and energy requirements. It compares CO₂ emissions from regulated energy use (DER) with those of an equivalent dwelling built to Part L 2021 (TER), a notional dwelling 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. 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, ii) Be seen: monitor, verify and report on energy performance
- B. 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.

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.

London Borough of Haringey Local Plan Strategic Policies 2013-2026

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% in emissions 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.

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;
 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.

SP5: Water Management and Flooding

The Council will require all development in Haringey to be water efficient during construction and operation and to reduce all forms of flood risk. All development shall:

- Improve the water environment, water quality and drainage systems;
- Minimise water use and illustrate how development would contribute to general and flash flooding;
- Take account of flood risk vulnerability classification as set out in paragraph 100 of the NPPF and will apply the NPPF Sequential Test and Exception Test;
- Implement measures to prevent (or mitigate as last resort) local surface water and downstream flooding;
- Implement Sustainable Drainage Systems from strategic to individual site level to improve water attenuation, quality and amenity;

SP6: Waste and Recycling

The Council supports the objectives of sustainable waste management set out by the Government in PPS10 Planning for Sustainable Waste Management and the Mayor's London Plan. To achieve these, the Council shall:

- Maximise self-sufficiency in waste management capacity;

- Seek to minimise waste creation, increase recycling rates in relation to commercial, industrial and municipal waste in order to achieve the Mayor's recycling targets;
- Address waste as a resource and look to disposal as the last option, in line with the Mayor's waste hierarchy;
- Require integrated, well-designed recycling facilities to be incorporated into all new developments;
- Monitor changes in the stock of waste management facilities, waste arisings, and the amount of waste recycled, recovered and going for disposal;

Haringey will require Site Waste Management Plans for all major applications to identify volume and types of demolition and construction waste and to demonstrate how waste will be minimised and managed during construction and occupation.

Development Management DPD, adopted July 2017

Policy DM21: Sustainable Design, Layout and Construction

- A. All new development, including building and landscape works, will be expected to consider and implement sustainable design, layout and construction techniques. Proposals should:
 - a. Apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements;
 - b. Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems;
 - c. Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls
 - d. Wherever possible, use building materials with high environmental performance ratings; and
 - e. Seek opportunities for locally sourced labour.
- B. The Council will support appropriate measures to sustainably retrofit existing homes and non-residential buildings.
- C. Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted.
- D. Consideration will be given to the use of carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals are unable to meet carbon dioxide emission reduction targets on-site.

Policy DM22: Decentralised Energy

- A. Subject to other policy requirements, proposals that contribute to the provision and use of Decentralised Energy network infrastructure will be supported. Communal energy systems
- B. All development that incorporates site-wide communal energy systems should examine opportunities for extending such systems, irrespective of whether it is connected to a DE network.

All development that incorporates site-wide communal energy systems should optimise opportunities for extending such systems beyond the site boundary to supply energy to neighbouring existing and planned future developments.

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 average carbon emissions and savings.

Table 1. Carbon Dioxide emissions after each stage of the Energy Hierarchy

	Regulated Carbon dioxide emissions (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	2.8	
After Energy Demand Reduction (Be Lean)	2.1	
After Heat Network Connection (Be Clean)	2.1	
After Renewables (Be Green)	0	

Table 2. Carbon Dioxide Savings from each stage of the Energy Hierarchy

	Regulated Carbon dioxide savings	
	Tonnes CO ₂ per annum	%
Be Lean: Savings from Energy Demand Reduction	0.7	24
Be Clean: Savings from Heat Network	0	0
Be Green: Savings from Renewable Energy	2.1	74
Cumulative on-site savings	2.8	99
Carbon Shortfall	0.14	
(Tonnes CO ₂)		
Cumulative savings for off-set payment	1	
Cash in-lieu contribution (£)	90	

a. Baseline Model

In accordance with London Plan Policy SI 2, a baseline model is run assuming the development complied with Part L 2021 of the Building Regulations. This baseline 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 heating and hot water supply would be provided by a heatpump and any active cooling would be provided by electrically powered equipment. The comparative Be 'Lean' model assumes the same heating strategy.

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 CO₂ 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 3. Energy Efficient Design Specification

Element	Building Regulations 2021 Standard	Specification
Wall	0.18 W/m ² k	0.15W/m ² k
Roof	0.13 W/ m ² k	0.11 W/ m ² k
Glazing	1.4 W/ m ² k	1.0 W/ m ² k (G-value 0.63)

Table 4. Development Part L Fabric Energy Efficiency Standard (FEES)

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement %
Development Total	41.29	40.16	3

Thermal Bridging - Thermal bridging will be reduced. The thermal bridging calculations achieve an average γ -value of 0.065 aligning with enhanced construction detail and cold bridges will be avoided.

Air Permeability – designed to achieve an air permeability score of 3

Thermal Mass - The average thermal mass is 109 kJ/m²K.

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 luminaires only.

Ventilation - The use of natural ventilation is proposed for the dwelling.

Space Heating & Cooling - Space heating will be provided by underfloor heating by the ASHP.

Domestic Hot Water (DHW) system – domestic hot water is supplied for the dwelling via the built in cylinder.

Waste Water Heat Recovery – A Zynbo PiPe 75 System A instantaneous system will be used

Energy Use Intensity and Space Heating Demand

Table 5. 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	58	23.93	35	15	SAP10.2

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

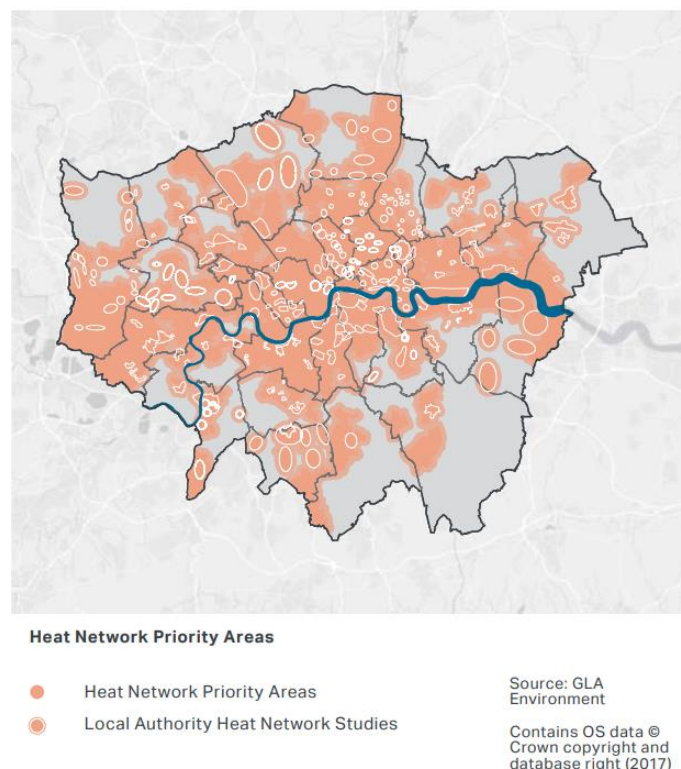
- A. Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.
- B.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

There is no existing or planned heat and energy network in the vicinity and the site does not fall into an opportunity area with decentralised energy potential as identified in the London 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 its location; it is apparent that the use of 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

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 6. 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 impact • 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 CO₂ 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 CO₂	• 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 CO₂ • 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 an air source heat pump and PV panels are to be incorporated in the design because it achieves a CO₂ percentage reduction of **74%** contributing to an overall reduction of **99%** in carbon emissions.

Table 7. Photovoltaic Panels (per flat)

System size	Orientation	Degree	Panels
2 kWp	South	30	8 (approx)

Table 8. ASHP Specification

Seasonal Coefficient of Performance (SCOP)		Seasonal Energy Efficiency Ratio (SEER)	
35°C	55°C	7°C	18°C
5.2	3.47	5.95	8.73

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.

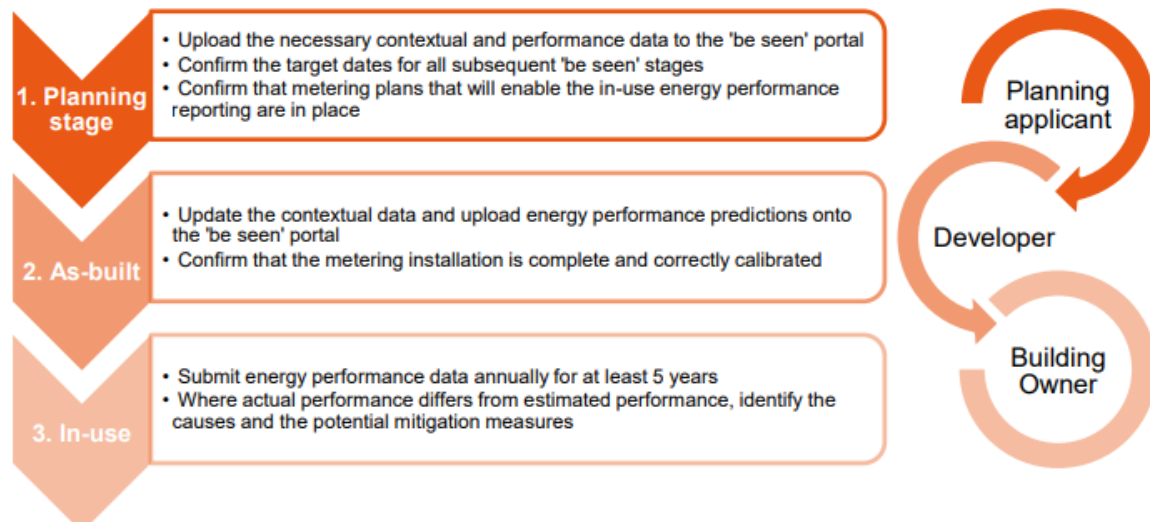
1.2.4 Ensuring that the actual energy and carbon performance of buildings is aligned with the estimated energy and carbon performance will also be a key factor in achieving a zero-carbon London.

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



Smart metering equipment will be installed 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:

- Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
- Avoiding internal overheating and contributing to the urban heat island effect
- Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
- Minimising pollution (including noise, air and urban runoff)
- Minimising the generation of waste and maximising reuse or recycling
- Avoiding impacts from natural hazards (including flooding)
- Ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
- Securing sustainable procurement of materials, using local supplies where feasible, and
- 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 2021.

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

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

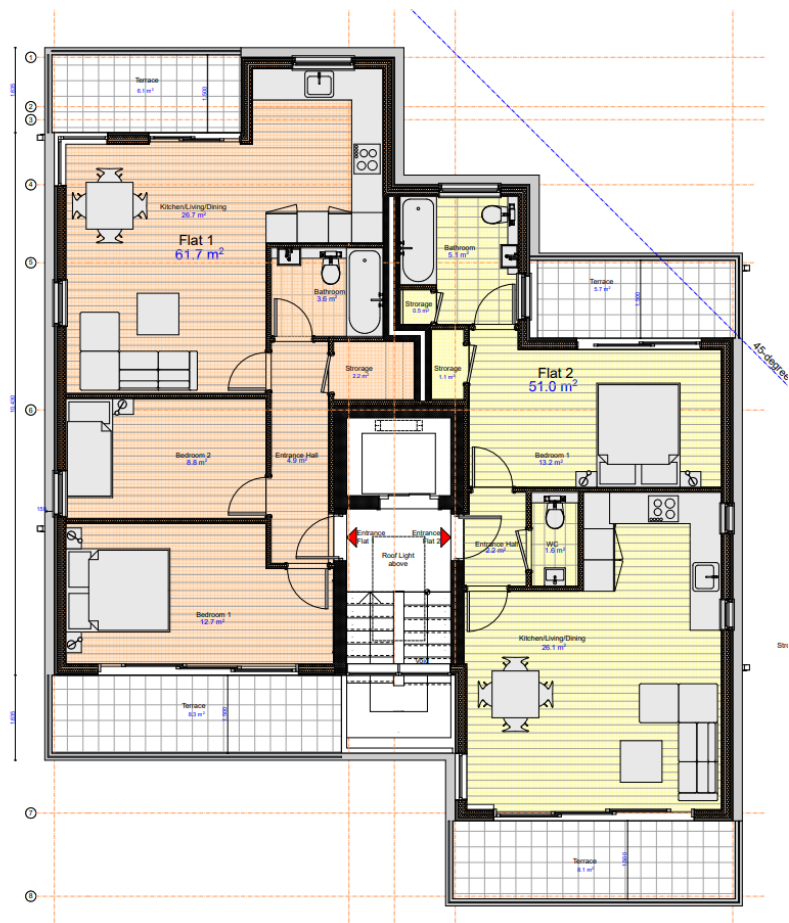
Minimise Heat Generation Through Energy Efficient Design

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, g-value of 0.63, higher air tightness and reduced cold bridging.

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



c. Cooling Hierarchy

The following strategy has been defined according the cooling hierarchy in Policy SI4 of the London Plan.

Table 9. Cooling Hierarchy

Cooling Hierarchy category	
1.Reduce the amount of heat entering the building through orientation, shading, high albedo material, fenestration, insulation and the provision of green infrastructure.	The development is designed to incorporate well insulated walls with high thermal resistance to minimize heat transfer through conduction. Additionally, the proposal includes the integration of solar control glazing to reduce solar heat gain.
2. Minimise internal heat generation through energy efficient design	Low U-values and passive measures have been implemented as outlined in section 4.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings.	As above.
4. Provide passive ventilation	The project has lots of opportunity for natural ventilation, having openings on three facades. Larger openings are included at the terraces on both the north and south (See Figure 4). The GHA Overheating Tool was also completed and showed low risk, demonstrating no need for further cooling measures.
5. Provide mechanical ventilation	Mechanical ventilation is not required as the project achieves sufficient cooling through other methods.
6. Provide active cooling system	As above.

d. 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 10. 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

e. 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:

- Use of eco-friendly building materials
- Non-toxic paints
- Installation of energy efficient appliances and devices
- 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.

Resource efficiency

- Pre-demolition audit to be carried out and target benchmark of ≤ 11.1 tonnes of construction waste per 100m²;

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;

Operational Waste

Target diversion from landfill rate to be set.

A space for reuse and recycling has been included at the ground floor unit for the residents exclusive use.

f. Flood Risk

Flood Risk

The development site is located in a Low Flood Risk Area on the Environment Agency Flood Risk Map.

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

The proposed development is limited in what biodiversity measures it can include as it relates to a roof extension on top of an existing building. The only scope for greening within the site constraints would be a green roof, however due to the PV roof requirement this is not feasible. Planners have also expressed a green roof is not desirable. Biodiversity could be encouraged through the inclusion of planters for the terraces.

6.CONCLUSION

The development has been designed to exceed Part L building regulations requirements. In line with the national and local policies, regulated CO₂ emissions from the development will be reduced by **99%** 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 **74%** contributing to the overall reduction of **99%** in carbon emissions. The remainder is made up from a fabric first approach with U-values outlined in the specification column of Table 3 on Page 10 of this report.

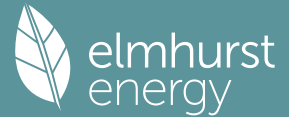
An appraisal of the proposed development has been undertaken against key sustainability objectives identified from relevant policy guidance. The framework for the appraisal was guided by the National Plan. This process has ensured that the development responds to the sustainable development objectives 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.

7. APPENDIX

A. SAP Calculations

i. Baseline

Full SAP Calculation Printout



Property Reference	6 Brownlow Road			Issued on Date	07/02/2024
Assessment Reference	Option 3 - Heatpump + PV - 1	Prop Type Ref	6 Brownlow Road		
Property	Daisy Court, 6 , Brownlow Road, LONDON, N11 2DE				
SAP Rating	95 A	DER	0.43	TER	15.41
Environmental	100 A	% DER < TER			97.21
CO ₂ Emissions (t/year)	0	DFEE	39.17	TFEE	40.31
Compliance Check	See BREL	% DFEE < TFEE			2.84
% DPER < TPER	80.03	DPER	16.44	TPER	82.33
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7000	2.5000	154.2500
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7000		
Dwelling volume			154.2500

2. Ventilation rate

		m ³ 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)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	
Pressure test	20.0000 / (5) =	
Pressure Test Method	Yes	
Measured/design AP50	Blower Door	
Infiltration rate	3.0000 (17)	
Number of sides sheltered	0.2797 (18)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Effective ac	0.3566	0.3496	0.3426	0.3076	0.3006	0.2657	0.2657	0.2587	0.2797	0.3006	0.3146	0.3286
	0.5636	0.5611	0.5587	0.5473	0.5452	0.5353	0.5353	0.5335	0.5391	0.5452	0.5495	0.5540

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
PROPOSED (Uw = 1.00)			22.0100	0.9615	21.1635		(27)
EXTERNAL	62.7800	22.0100	40.7700	0.1500	6.1155	18.0000	733.8600 (29a)
HALLWAY	16.8000		16.8000	0.1400	2.3520	18.0000	302.4000 (29a)
FLAT ROOF	61.7000		61.7000	0.1100	6.7870	9.0000	555.3000 (30)
Total net area of external elements Aum(A, m ²)			141.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.4180		(33)
PARTY WALL			11.2800	0.0000	0.0000	180.0000	2030.4000 (32)
PARTY FLOOR			61.7000			40.0000	2468.0000 (32d)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	11.5800	0.3000	3.4740
E2 Other lintels (including other steel lintels)	5.9500	0.0400	0.2380
E3 Sill	25.4000	0.0500	1.2700
E4 Jamb	25.1100	0.0700	1.7577
E7 Party floor between dwellings (in blocks of flats)	25.1100	0.0400	1.0044
E14 Flat roof	10.0000	0.0900	0.9000
E16 Corner (normal)	2.5000	-0.0900	-0.2250
E17 Corner (inverted - internal area greater than external area)			

Full SAP Calculation Printout



E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.1200	0.3000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.2200	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.1691 (36)
Point Thermal bridges			0.0000
Total fabric heat loss	(33) + (36) + (36a) =		45.5871 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	28.6871	28.5615	28.4383	27.8598	27.7516	27.2477	27.2477	27.1544	27.4418	27.7516	27.9705	28.1994 (38)
Heat transfer coeff												
	74.2742	74.1485	74.0254	73.4469	73.3386	72.8348	72.8348	72.7415	73.0288	73.3386	73.5576	73.7865 (39)
Average = Sum(39)m / 12 =												73.4463
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2038	1.2018	1.1998	1.1904	1.1886	1.1805	1.1805	1.1790	1.1836	1.1886	1.1922	1.1959 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0293 (42)
Hot water usage for mixer showers	58.2438	57.3685	56.0930	53.6526	51.8517	49.8433	48.7017	49.9675	51.3551	53.5115	56.0043	58.0206	(42a)
Hot water usage for baths	26.4947	26.1012	25.5471	24.5254	23.7604	22.9121	22.4539	23.0042	23.6033	24.5109	25.5537	26.4051	(42b)
Hot water usage for other uses	37.2755	35.9201	34.5646	33.2091	31.8536	30.4982	30.4982	31.8536	33.2091	34.5646	35.9201	37.2755	(42c)
Average daily hot water use (litres/day)												112.1504	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.0140	119.3897	116.2047	111.3871	107.4657	103.2536	101.6538	104.8253	108.1675	112.5870	117.4780	121.7012	(44)
Energy content (annual)	193.2403	170.0094	178.6023	152.4834	144.6695	126.9623	122.9415	129.7956	133.3813	152.7795	167.3690	190.5547	(45)
Distribution loss (46)m = 0.15 x (45)m	28.9860	25.5014	26.7903	22.8725	21.7004	19.0443	18.4412	19.4693	20.0072	22.9169	25.1053	28.5832	(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	251.6567	222.7726	237.0187	209.0154	203.0859	183.4943	181.3579	188.2120	189.9133	211.1959	223.9010	248.9711	(62)
WWHRS	-54.4900	-48.1914	-50.4633	-41.7856	-38.9427	-33.3235	-31.2355	-33.2158	-34.4778	-40.6455	-46.0465	-53.4810	(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	197.1667	174.5811	186.5554	167.2298	164.1432	150.1708	150.1224	154.9962	155.4355	170.5504	177.8545	195.4902	(64)
12Total per year (kWh/year)												2044.2962	(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	110.9855	98.7387	106.1184	95.9263	94.8357	87.4406	87.6112	89.8902	89.5749	97.5323	100.8758	110.0926	(65)

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

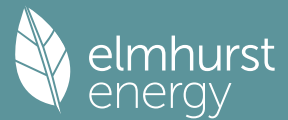
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
89.3837	98.9605	89.3837	92.3631	89.3837	92.3631	89.3837	89.3837	92.3631	89.3837	92.3631	89.3837	89.3837	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
177.2131	179.0520	174.4180	164.5527	152.0996	140.3954	132.5763	130.7374	135.3714	145.2367	157.6898	169.3940	169.3940	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	(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)													
-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	(71)
Water heating gains (Table 5)													
149.1741	146.9326	142.6322	133.2310	127.4674	121.4452	117.7569	120.8201	124.4096	131.0918	140.1053	147.9739	147.9739	(72)
Total internal gains	469.2099	478.3841	459.8729	443.5859	422.3897	407.6428	393.1560	394.3802	405.5831	419.1512	443.5972	460.1906	(73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF		Access	Gains				
				m2	Table 6a		Specific data	Specific data		factor	W				
					W/m2		or Table 6b	or Table 6c		Table 6d					
North				5.8100	10.6334		0.6300	0.7000		0.7700	18.8808 (74)				
East				7.7300	19.6403		0.6300	0.7000		0.7700	46.3979 (76)				
West				8.4700	19.6403		0.6300	0.7000		0.7700	50.8396 (80)				
Solar gains				116.1184	226.2995	374.5732	555.3556	692.5802	715.1948	678.2795	573.9320	438.0527	268.6600	144.5357	95.7034 (83)
Total gains				585.3283	704.6836	834.4461	998.9416	1114.9699	1122.8376	1071.4355	968.3123	843.6358	687.8112	588.1329	555.8940 (84)

7. Mean internal temperature (heating season)

Full SAP Calculation Printout



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	22.7758	22.8144	22.8524	23.0324	23.0664	23.2259	23.2259	23.2557	23.1642	23.0664	22.9977	22.9264	
alpha	2.5184	2.5210	2.5235	2.5355	2.5378	2.5484	2.5484	2.5504	2.5443	2.5378	2.5332	2.5284	
util living area	0.9142	0.8714	0.7995	0.6741	0.5289	0.3881	0.2893	0.3302	0.5200	0.7534	0.8781	0.9228 (86)	
Living	18.6941	19.1032	19.6700	20.2927	20.6966	20.9000	20.9654	20.9508	20.7854	20.1962	19.3388	18.6178	
Non living	17.2673	17.7735	18.4652	19.2029	19.6516	19.8620	19.9175	19.9094	19.7613	19.1189	18.0823	17.1763	
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	19.8204	19.1032	19.6700	20.2927	20.6966	20.9000	20.9654	20.9508	20.7854	20.1962	19.3388	18.9510 (87)	
Th 2	19.9170	19.9186	19.9202	19.9277	19.9291	19.9357	19.9357	19.9369	19.9331	19.9291	19.9263	19.9233 (88)	
util rest of house	0.9027	0.8553	0.7755	0.6387	0.4823	0.3306	0.2227	0.2590	0.4567	0.7154	0.8599	0.9124 (89)	
MIT 2	18.8606	17.7735	18.4652	19.2029	19.6516	19.8620	19.9175	19.9094	19.7613	19.1189	18.0823	17.6713 (90)	
Living area fraction									fLA = Living area / (4) =				0.4327 (91)
MIT	19.2760	18.3489	18.9866	19.6745	20.1038	20.3112	20.3709	20.3601	20.2045	19.5851	18.6260	18.2251 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.2760	18.3489	18.9866	19.6745	20.1038	20.3112	20.3709	20.3601	20.2045	19.5851	18.6260	18.2251 (93)	

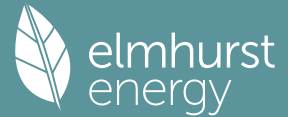
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8950	0.8267	0.7518	0.6297	0.4902	0.3513	0.2504	0.2879	0.4735	0.7018	0.8328	0.8918 (94)
Useful gains	523.8555	582.5823	627.3308	629.0085	546.5189	394.4890	268.2411	278.7462	399.4869	482.7063	489.7891	495.7190 (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	1112.3267	997.2177	924.3233	791.3536	616.3229	415.9713	274.6544	288.0614	445.8010	658.9558	847.8282	1034.8624 (97)
Space heating kWh	437.8226	278.6349	220.9624	116.8885	51.9341	0.0000	0.0000	0.0000	0.0000	131.1296	257.7881	401.1227 (98a)
Space heating requirement - total per year (kWh/year)												1896.2830
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	437.8226	278.6349	220.9624	116.8885	51.9341	0.0000	0.0000	0.0000	0.0000	131.1296	257.7881	401.1227 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1896.2830
Space heating per m2										(98c) / (4) =		30.7339 (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 %)													302.4167 (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	437.8226	278.6349	220.9624	116.8885	51.9341	0.0000	0.0000	0.0000	0.0000	131.1296	257.7881	401.1227 (98)	
Space heating efficiency (main heating system 1)	302.4167	302.4167	302.4167	302.4167	302.4167	0.0000	0.0000	0.0000	0.0000	302.4167	302.4167	302.4167 (210)	
Space heating fuel (main heating system)	144.7746	92.1361	73.0656	38.6515	17.1730	0.0000	0.0000	0.0000	0.0000	43.3606	85.2427	132.6391 (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	197.1667	174.5811	186.5554	167.2298	164.1432	150.1708	150.1224	154.9962	155.4355	170.5504	177.8545	195.4902 (64)	
Efficiency of water heater	218.5088	218.5088	218.5088	218.5088	218.5088	218.5088	218.5088	218.5088	218.5088	218.5088	218.5088	218.5088 (216)	
Fuel for water heating, kWh/month	90.2328	79.8966	85.3766	76.5323	75.1197	68.7253	68.7031	70.9336	71.1347	78.0520	81.3947	89.4656 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	17.2815	13.8639	12.4829	9.1455	7.0642	5.7715	6.4442	8.3765	10.8802	14.2754	16.1240	17.7618 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-36.0541	-52.0550	-76.5006	-86.3917	-92.7598	-84.7370	-83.7470	-78.5685	-68.9533	-59.0741	-39.6491	-30.8238 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-14.0324	-31.5250	-65.8456	-104.3803	-142.9230	-146.9767	-144.9045	-121.2055	-87.5098	-47.7718	-19.7607	-11.0900 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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													627.0431 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													218.5088
Water heating fuel used													935.5670 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													139.4716 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													

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PV generation	-1727.2394 (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	-25.1577 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	627.0431	0.1558	97.7019 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	935.5670	0.1404	131.3986 (264)
Space and water heating			229.1005 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	139.4716	0.1443	20.1301 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-789.3140	0.1346	-106.2302
PV Unit electricity exported	-937.9254	0.1243	-116.5961
Total			-222.8263 (269)
Total CO ₂ , kg/year			26.4043 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.4300 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	627.0431	1.5768	988.7171 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	935.5670	1.5193	1421.4100 (278)
Space and water heating			2410.1271 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	139.4716	1.5338	213.9262 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-789.3140	1.4974	-1181.9303
PV Unit electricity exported	-937.9254	0.4562	-427.9168
Total			-1609.8471 (283)
Total Primary energy kWh/year			1014.2062 (286)
Dwelling Primary energy Rate (DPER)			16.4400 (287)

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

1. Overall dwelling characteristics

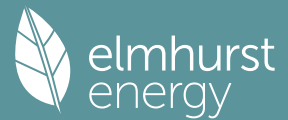
	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7000 (1b)	x 2.5000 (2b)	= 154.2500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2500 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1297 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3797 (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) = 0.3797 (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	0.4841	0.4746	0.4651	0.4176	0.4081	0.3607	0.3607	0.3512	0.3797	0.4081	0.4271	0.4461 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5650	0.5650	0.5617	0.5721	0.5833	0.5912	0.5995 (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	
TER Opening Type (Uw = 1.20)			15.4300	1.1450	17.6679			(27)
EXTERNAL	62.7800	15.4300	47.3500	0.1800	8.5230			(29a)
HALLWAY	16.8000		16.8000	0.1800	3.0240			(29a)
FLAT ROOF	61.7000		61.7000	0.1100	6.7870			(30)
Total net area of external elements Aum(A, m2)			141.2800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.0019			(33)
PARTY WALL			11.2800	0.0000	0.0000			(32)

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

98.7028 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	11.5800	0.0500	0.5790	
E3 Sill	5.9500	0.0500	0.2975	
E4 Jamb	25.4000	0.0500	1.2700	
E7 Party floor between dwellings (in blocks of flats)	25.1100	0.0700	1.7577	
E14 Flat roof	25.1100	0.0800	2.0088	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250	
E18 Party wall between dwellings	7.5000	0.0600	0.4500	
E25 Staggered party wall between dwellings	2.5000	0.0600	0.1500	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.2200	0.0000	0.0000	

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

Point Thermal Bridges

7.1880 (36)

Total fabric heat loss

(33) + (36) + (36a) = 43.1899 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	31.4150	31.1834	30.9564	29.8902	29.6908	28.7621	28.7621	28.5902	29.1198	29.6908	30.0943	30.5162	(38)
Average = Sum(39)m / 12 =	74.6049	74.3733	74.1464	73.0802	72.8807	71.9521	71.9521	71.7801	72.3098	72.8807	73.2842	73.7061	(39)
												73.0792	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2092	1.2054	1.2017	1.1844	1.1812	1.1662	1.1662	1.1634	1.1720	1.1812	1.1878	1.1946	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	
												1.1844	
												31	

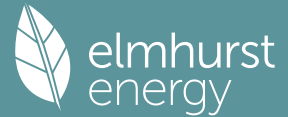
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0293 (42)
Hot water usage for mixer showers													
58.2438	57.3685	56.0930	53.6526	51.8517	49.8433	48.7017	49.9675	51.3551	53.5115	56.0043	58.0206	(42a)	
Hot water usage for baths													
25.1700	24.7961	24.2697	23.2992	22.5724	21.7665	21.3312	21.8539	22.4231	23.2854	24.2760	25.0849	(42b)	
Hot water usage for other uses													
35.4117	34.1240	32.8363	31.5486	30.2609	28.9732	28.9732	30.2609	31.5486	32.8363	34.1240	35.4117	(42c)	
Average daily hot water use (litres/day)													109.2278 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
118.8255	116.2887	113.1991	108.5004	104.6850	100.5831	99.0062	102.0824	105.3268	109.6333	114.4043	118.5172	(44)	
Energy content	188.1905	165.5935	173.9828	148.5316	140.9261	123.6786	119.7394	126.3994	129.8785	148.7713	162.9899	185.5693	(45)
Energy content (annual)										Total = Sum(45)m =		1814.2510	
Distribution loss (46)m = 0.15 x (45)m													
28.2286	24.8390	26.0974	22.2797	21.1389	18.5518	17.9609	18.9599	19.4818	22.3157	24.4485	27.8354	(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	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	(61)	
Total heat required for water heating calculated for each month													
239.1166	211.5912	224.9089	197.8149	191.8522	172.9619	170.6655	177.3254	179.1618	199.6974	212.2732	236.4954	(62)	
WWHRS	-26.6266	-23.5488	-24.6589	-20.4186	-19.0294	-16.2836	-15.2633	-16.2309	-16.8476	-19.8615	-22.5006	-26.1335	(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													
212.4899	188.0424	200.2499	177.3964	172.8228	156.6783	155.4022	161.0945	162.3142	179.8359	189.7726	210.3619	(64)	
									Total per year (kWh/year) = Sum(64)m =		2166.4611	(64)	
12Total per year (kWh/year)											2166	(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													
103.3142	91.8580	98.5901	88.8134	87.5988	80.5498	80.5542	82.7686	82.6112	90.2073	93.6208	102.4427	(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	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	89.3837	98.9605	89.3837	92.3631	89.3837	92.3631	89.3837	89.3837	92.3631	89.3837	92.3631	89.3837 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	177.2131	179.0520	174.4180	164.5527	152.0996	140.3954	132.5763	130.7374	135.3714	145.2367	157.6898	169.3940 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463 (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)												
	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708 (71)
Water heating gains (Table 5)												
	138.8632	136.6935	132.5136	123.3520	117.7403	111.8747	108.2718	111.2482	114.7378	121.2464	130.0289	137.6917 (72)

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Total internal gains
461.8990 471.1451 452.7543 436.7069 415.6627 398.0723 383.6708 384.8083 395.9114 412.3058 436.5209 452.9084 (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					4.0700	10.6334	0.6300	0.7000	0.7700			13.2263 (74)
East					5.4200	19.6403	0.6300	0.7000	0.7700			32.5326 (76)
West					5.9400	19.6403	0.6300	0.7000	0.7700			35.6538 (80)
Solar gains	81.4126	158.6631	262.6197	389.3638	485.5659	501.4173	475.5378	402.3854	307.1247	188.3628	101.3367	67.0992 (83)
Total gains	543.3116	629.8081	715.3740	826.0707	901.2286	899.4896	859.2086	787.1937	703.0362	600.6686	537.8576	520.0077 (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)												
tau	22.6749	22.7455	22.8151	23.1479	23.2113	23.5109	23.5109	23.5672	23.3946	23.2113	23.0835	22.9514
alpha	2.5117	2.5164	2.5210	2.5432	2.5474	2.5674	2.5674	2.5711	2.5596	2.5474	2.5389	2.5301
util living area	0.9258	0.8949	0.8427	0.7418	0.6102	0.4626	0.3500	0.3921	0.5882	0.7958	0.8959	0.9322 (86)
MIT	18.5755	18.9289	19.4548	20.1063	20.5787	20.8531	20.9475	20.9287	20.7177	20.0774	19.2351	18.5286 (87)
Th 2	19.9127	19.9157	19.9186	19.9325	19.9351	19.9472	19.9472	19.9472	19.9425	19.9351	19.9298	19.9243 (88)
util rest of house	0.9156	0.8809	0.8219	0.7090	0.5625	0.3987	0.2725	0.3114	0.5231	0.7613	0.8797	0.9229 (89)
MIT 2	17.1181	17.5593	18.2100	19.0009	19.5409	19.8361	19.9187	19.9084	19.7104	18.9918	17.9593	17.0662 (90)
Living area fraction												0.4327 (91)
MIT	17.7488	18.1520	18.7487	19.4792	19.9900	20.2762	20.3639	20.3499	20.1463	19.4616	18.5114	17.6990 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7488	18.1520	18.7487	19.4792	19.9900	20.2762	20.3639	20.3499	20.1463	19.4616	18.5114	17.6990 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8889	0.8525	0.7953	0.6936	0.5651	0.4193	0.3039	0.3430	0.5364	0.7436	0.8528	0.8971 (94)
Ext temp.	482.9401	536.9002	568.9717	572.9770	509.3139	377.1734	261.0931	270.0400	377.1183	446.6715	458.6616	466.5233 (95)
Heat loss rate W	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)
Space heating	1003.3438	985.5945	908.1946	773.1315	604.1824	408.4112	270.8215	283.5250	437.2058	645.8392	836.2778	994.9616 (97)
Space heating requirement - total per year (kWh/year)	387.1804	301.5226	252.3818	144.1112	70.5822	0.0000	0.0000	0.0000	0.0000	148.1808	271.8836	393.1581 (98a)
Solar heating kWh												1969.0007
Solar heating contribution - total per year (kWh/year)	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)
Space heating kWh	387.1804	301.5226	252.3818	144.1112	70.5822	0.0000	0.0000	0.0000	0.0000	148.1808	271.8836	393.1581 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1969.0007
Space heating per m2										(98c) / (4) =		31.9125 (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)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	387.1804	301.5226	252.3818	144.1112	70.5822	0.0000	0.0000	0.0000	0.0000	148.1808	271.8836	393.1581 (98)
Space heating fuel (main heating system)	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 efficiency (main heating system 2)	419.4804	326.6767	273.4364	156.1335	76.4704	0.0000	0.0000	0.0000	0.0000	160.5426	294.5651	425.9567 (211)
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 (212)
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 (213)
Water heating	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 requirement	212.4899	188.0424	200.2499	177.3964	172.8228	156.6783	155.4022	161.0945	162.3142	179.8359	189.7726	210.3619 (64)
Efficiency of water heater	85.3876	85.1129	84.5798	83.5978	82.2163	79.8000	79.8000	79.8000	79.8000	83.6290	84.8655	79.8000 (216)
Fuel for water heating, kWh/month	248.8534	220.9329	236.7586	212.2022	210.2050	196.3387	194.7396	201.8728	203.4013	215.0402	223.6156	246.2065 (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	18.5722	14.8993	13.4151	9.8285	7.5918	6.2026	6.9255	9.0020	11.6928	15.3415	17.3282	19.0883 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-13.7324	-20.6272	-31.5699	-37.8756	-42.9663	-40.8971	-40.4073	-37.0864	-31.6135	-24.6139	-15.5428	-11.7299 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)												

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(233b)m	-4.3358	-9.3719	-19.1030	-29.4024	-39.5802	-40.0204	-39.5422	-33.1501	-23.8744	-13.6237	-5.8592	-3.4098	(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												2133.2619	(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												2610.1669	(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)												149.8880	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-609.9354	(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												4369.3813	(238)

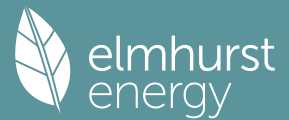
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2133.2619	0.2100	447.9850 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2610.1669	0.2100	548.1350 (264)
Space and water heating			996.1200 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	149.8880	0.1443	21.6335 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-348.6623	0.1333	-46.4665
PV Unit electricity exported	-261.2731	0.1252	-32.7091
Total			-79.1756 (269)
Total CO2, kg/year			950.5071 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.4100 (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	2133.2619	1.1300	2410.5859 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2610.1669	1.1300	2949.4886 (278)
Space and water heating			5360.0745 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	149.8880	1.5338	229.9032 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-348.6623	1.4925	-520.3684
PV Unit electricity exported	-261.2731	0.4595	-120.0561
Total			-640.4246 (283)
Total Primary energy kWh/year			5079.6539 (286)
Target Primary Energy Rate (TPER)			82.3300 (287)

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Property Reference	6 Brownlow Road				Issued on Date	07/02/2024	
Assessment Reference	Option 3 - Heatpump + PV - 2			Prop Type Ref	6 Brownlow Road		
Property	Daisy Court, 6 , Brownlow Road, LONDON, N11 2DE						
SAP Rating	96 A	DER	0.10	TER	16.99		
Environmental	100 A	% DER < TER				99.41	
CO ₂ Emissions (t/year)	-0.02	DFEE	41.35	TFEE	42.47		
Compliance Check	See BREL	% DFEE < TFEE				2.65	
% DPER < TPER	82.13	DPER	16.27	TPER	91.04		
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.0000 (1b)	2.5000 (2b)	127.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.0000		127.5000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	127.5000 (5)

2. Ventilation rate

		m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1569 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.3069	(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) =	0.3069 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.3912	0.3836	0.3759	0.3375	0.3299	0.2915	0.2915	0.2838	0.3069	0.3299	0.3452	0.3606 (22b)
	0.5765	0.5736	0.5707	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650 (25)

3. Heat losses and heat loss parameter

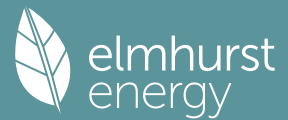
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
PROPOSED (Uw = 1.00)			20.0400	0.9615	19.2692		(27)
EXTERNAL	64.1000	20.0400	44.0600	0.1500	6.6090	18.0000	793.0800 (29a)
HALLWAY	14.2800		14.2800	0.1400	1.9992	18.0000	257.0400 (29a)
FLAT ROOF	51.0000		51.0000	0.1100	5.6100	9.0000	459.0000 (30)
Total net area of external elements Aum(A, m ²)			129.3800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.4874		(33)
PARTY WALL			11.2800	0.0000	0.0000	180.0000	2030.4000 (32)
PARTY FLOOR			51.0000			40.0000	2040.0000 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5579.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 109.4024 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.4500	0.3000	3.1350
E3 Sill	4.2000	0.0400	0.1680
E4 Jamb	23.6000	0.0500	1.1800
E7 Party floor between dwellings (in blocks of flats)	25.6400	0.0700	1.7948
E14 Flat roof	25.6400	0.0400	1.0256
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250

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E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.1200	0.3000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.2300	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.7284 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	42.2158 (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	24.2578	24.1328	24.0102	23.4345	23.3268	22.8253	22.8253	22.7325	23.0185	23.3268	23.5447	23.7725 (38)
Heat transfer coeff	66.4737	66.3486	66.2261	65.6503	65.5426	65.0412	65.0412	64.9483	65.2343	65.5426	65.7605	65.9883 (39)
Average = Sum(39)m / 12 =												65.6498
HLP	1.3034	1.3010	1.2986	1.2873	1.2851	1.2753	1.2753	1.2735	1.2791	1.2851	1.2894	1.2939 (40)
HLP (average)												1.2873
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.7196 (42)
Hot water usage for mixer showers	53.0510	52.2538	51.0920	48.8692	47.2288	45.3995	44.3597	45.5127	46.7765	48.7407	51.0112	52.8478 (42a)	
Hot water usage for baths	24.1441	23.7855	23.2806	22.3496	21.6524	20.8794	20.4618	20.9633	21.5092	22.3364	23.2866	24.0625 (42b)	
Hot water usage for other uses	33.9370	32.7029	31.4688	30.2348	29.0007	27.7666	27.7666	29.0007	30.2348	31.4688	32.7029	33.9370 (42c)	
Average daily hot water use (litres/day)												102.1485 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	111.1321	108.7422	105.8415	101.4536	97.8820	94.0455	92.5882	95.4766	98.5205	102.5459	107.0007	110.8473 (44)	
Energy content (annual)	176.0061	154.8475	162.6744	138.8848	131.7679	115.6399	111.9774	118.2200	121.4857	139.1538	152.4422	173.5600 (45)	
Distribution loss (46)m = 0.15 x (45)m	26.4009	23.2271	24.4012	20.8327	19.7652	17.3460	16.7966	17.7330	18.2228	20.8731	22.8663	26.0340 (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	234.4225	207.6107	221.0908	195.4168	190.1843	172.1719	170.3938	176.6364	178.0177	197.5702	208.9742	231.9764 (62)	
WWHRS	-49.6320	-43.8949	-45.9642	-38.0602	-35.4707	-30.3526	-28.4507	-30.2545	-31.4039	-37.0218	-41.9412	-48.7129 (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	184.7906	163.7158	175.1266	157.3566	154.7136	141.8194	141.9431	146.3820	146.6137	160.5484	167.0330	183.2635 (64)	
12Total per year (kWh/year)												1923.3062 (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	105.2552	93.6974	100.8224	91.4048	90.5460	83.6759	83.9656	86.0413	85.6196	93.0018	95.9126	104.4418 (65)	

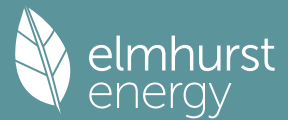
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5724	83.6695	75.5724	78.0915	75.5724	78.0915	75.5724	75.5724	78.0915	75.5724	78.0915	75.5724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	149.8308	151.3856	147.4676	139.1267	128.5978	118.7021	112.0911	110.5364	114.4543	122.7953	133.3242	143.2199 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979 (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)	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828 (71)
Water heating gains (Table 5)	141.4720	139.4306	135.5139	126.9511	121.7016	116.2165	112.8570	115.6469	118.9161	125.0024	133.2120	140.3788 (72)
Total internal gains	415.6688	423.2792	407.3475	392.9629	374.6653	361.8036	349.3141	350.5492	360.2555	372.1636	393.4212	407.9647 (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				2.0000	10.6334	0.6300	0.7000	0.7700	6.4994 (74)			
East				6.8400	19.6403	0.6300	0.7000	0.7700	41.0559 (76)			
South				2.7300	46.7521	0.6300	0.7000	0.7700	39.0063 (78)			
West				8.4700	19.6403	0.6300	0.7000	0.7700	50.8396 (80)			
Solar gains	137.4013	256.0702	398.5314	557.6450	670.6613	682.8045	651.4652	566.7110	454.7010	296.9972	168.8366	114.6937 (83)
Total gains	553.0701	679.3494	805.8789	950.6079	1045.3266	1044.6081	1000.7793	917.2602	814.9565	669.1608	562.2578	522.6584 (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	23.3155	23.3594	23.4027	23.6079	23.6467	23.8290	23.8290	23.8631	23.7585	23.6467	23.5683	23.4870
alpha	2.5544	2.5573	2.5602	2.5739	2.5764	2.5886	2.5886	2.5909	2.5839	2.5764	2.5712	2.5658
util living area	0.9076	0.8570	0.7789	0.6530	0.5123	0.3755	0.2779	0.3135	0.4918	0.7270	0.8661	0.9176 (86)
Living	18.8087	19.2475	19.7998	20.3711	20.7316	20.9127	20.9706	20.9592	20.8208	20.2928	19.4542	18.7268
Non living	17.3495	17.8877	18.5543	19.2226	19.6154	19.7994	19.8461	19.8408	19.7213	19.1612	18.1617	17.2528
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	19.8790	19.2475	19.7998	20.3711	20.7316	20.9127	20.9706	20.9592	20.8208	20.2928	19.4542	19.0448 (87)
Th 2	19.8382	19.8401	19.8420	19.8508	19.8525	19.8602	19.8602	19.8617	19.8572	19.8525	19.8491	19.8456 (88)
util rest of house	0.8943	0.8380	0.7514	0.6141	0.4624	0.3150	0.2089	0.2402	0.4250	0.6841	0.8448	0.9056 (89)
MIT 2	18.8460	17.8877	18.5543	19.2226	19.6154	19.7994	19.8461	19.8408	19.7213	19.1612	18.1617	17.7200 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.3544	18.5570	19.1673	19.7879	20.1647	20.3473	20.3995	20.3912	20.2625	19.7181	18.7978	18.3720 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3544	18.5570	19.1673	19.7879	20.1647	20.3473	20.3995	20.3912	20.2625	19.7181	18.7978	18.3720 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8880	0.8131	0.7334	0.6118	0.4764	0.3414	0.2419	0.2748	0.4496	0.6786	0.8216	0.8866 (94)
Useful gains	491.1491	552.3829	591.0323	581.5824	498.0063	356.5942	242.1118	252.1082	366.3638	454.0767	461.9273	463.4018 (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	1000.7230	906.1207	838.9052	714.7914	554.8011	373.8132	247.1268	259.2234	402.0040	597.6262	769.2562	935.1870 (97)
Space heating kWh	379.1230	237.7118	184.4175	95.9105	42.2553	0.0000	0.0000	0.0000	0.0000	106.8008	221.2769	351.0082 (98a)
Space heating requirement - total per year (kWh/year)												1618.5040
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	379.1230	237.7118	184.4175	95.9105	42.2553	0.0000	0.0000	0.0000	0.0000	106.8008	221.2769	351.0082 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1618.5040
Space heating per m2										(98c) / (4) =		31.7354 (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 %)												286.9848 (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	379.1230	237.7118	184.4175	95.9105	42.2553	0.0000	0.0000	0.0000	0.0000	106.8008	221.2769	351.0082 (98)
Space heating efficiency (main heating system 1)	286.9848	286.9848	286.9848	286.9848	286.9848	0.0000	0.0000	0.0000	0.0000	286.9848	286.9848	286.9848 (210)
Space heating fuel (main heating system)	132.1056	82.8308	64.2604	33.4200	14.7239	0.0000	0.0000	0.0000	0.0000	37.2148	77.1040	122.3090 (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	184.7906	163.7158	175.1266	157.3566	154.7136	141.8194	141.9431	146.3820	146.6137	160.5484	167.0330	183.2635 (64)
Efficiency of water heater	219.8664	219.8664	219.8664	219.8664	219.8664	219.8664	219.8664	219.8664	219.8664	219.8664	219.8664	219.8664 (216)
Fuel for water heating, kWh/month	84.0468	74.4615	79.6513	71.5692	70.3671	64.5025	64.5588	66.5777	66.6831	73.0209	75.9702	83.3522 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	14.6112	11.7217	10.5541	7.7324	5.9727	4.8797	5.4485	7.0822	9.1990	12.0696	13.6326	15.0173 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-35.3121	-50.4312	-73.2574	-81.6919	-86.9325	-79.1384	-78.2664	-73.7903	-65.2289	-56.6631	-38.6138	-30.2468 (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	-14.7744	-33.1488	-69.0889	-109.0801	-148.7503	-152.5753	-150.3852	-125.9837	-91.2342	-50.1828	-20.7960	-11.6670 (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												563.9685 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												219.8664
Water heating fuel used												874.7613 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												117.9210 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1727.2394 (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	-170.5886 (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	563.9685	0.1560	87.9809 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	874.7613	0.1404	122.8101 (264)
Space and water heating			210.7910 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	117.9210	0.1443	17.0196 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-749.5726	0.1348	-101.0640
PV Unit electricity exported	-977.6668	0.1244	-121.6615
Total			-222.7254 (269)
Total CO2, kg/year			5.0852 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.1000 (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	563.9685	1.5775	889.6527 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	874.7613	1.5191	1328.8462 (278)
Space and water heating			2218.4989 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	117.9210	1.5338	180.8711 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-749.5726	1.4983	-1123.1054
PV Unit electricity exported	-977.6668	0.4567	-446.5177
Total			-1569.6231 (283)
Total Primary energy kWh/year			829.7469 (286)
Dwelling Primary energy Rate (DPER)			16.2700 (287)

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

1. Overall dwelling characteristics

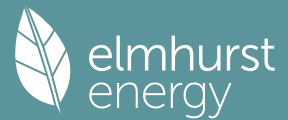
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	51.0000 (1b)	x 2.5000 (2b)	= 127.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.5000 (5)

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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1569 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4069 (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) = 0.4069 (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	0.5187	0.5086	0.4984	0.4475	0.4374	0.3865	0.3865	0.3763	0.4069	0.4374	0.4577	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5956	0.5747	0.5747	0.5708	0.5828	0.5956	0.6048	0.6143 (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	
TER Opening Type (Uw = 1.20)			12.7500	1.1450	14.5992			(27)
EXTERNAL	64.1000	12.7500	51.3500	0.1800	9.2430			(29a)
HALLWAY	14.2800		14.2800	0.1800	2.5704			(29a)
FLAT ROOF	51.0000		51.0000	0.1100	5.6100			(30)
Total net area of external elements Aum(A, m2)			129.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0226			(33)
PARTY WALL			11.2800	0.0000	0.0000			(32)

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

109.4024 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	10.4500	0.0500	0.5225	
E3 Sill	4.2000	0.0500	0.2100	
E4 Jamb	23.6000	0.0500	1.1800	
E7 Party floor between dwellings (in blocks of flats)	25.6400	0.0700	1.7948	
E14 Flat roof	25.6400	0.0800	2.0512	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250	
E18 Party wall between dwellings	7.5000	0.0600	0.4500	
E25 Staggered party wall between dwellings	2.5000	0.0600	0.1500	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.2300	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				7.0335 (36)
Point Thermal bridges				0.0000
Total fabric heat loss		(33) + (36) + (36a) =		39.0561 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	26.6987	26.4789	26.2634	25.2513	25.0620	24.1804	24.1804	24.0172	24.5200	25.0620	25.4450	25.8455	(38)
Average = Sum(39)m / 12 =	65.7549	65.5350	65.3195	64.3075	64.1181	63.2366	63.2366	63.0733	63.5761	64.1181	64.5012	64.9017	(39)
												64.3065	
HLP	1.2893	1.2850	1.2808	1.2609	1.2572	1.2399	1.2399	1.2367	1.2466	1.2572	1.2647	1.2726	(40)
HLP (average)												1.2609	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.7196 (42)
Hot water usage for mixer showers	53.0510	52.2538	51.0920	48.8692	47.2288	45.3995	44.3597	45.5127	46.7765	48.7407	51.0112	52.8478	(42a)
Hot water usage for baths	22.9369	22.5963	22.1166	21.2321	20.5698	19.8354	19.4388	19.9151	20.4338	21.2196	22.1223	22.8594	(42b)
Hot water usage for other uses	32.2401	31.0678	29.8954	28.7230	27.5507	26.3783	26.3783	27.5507	28.7230	29.8954	31.0678	32.2401	(42c)
Average daily hot water use (litres/day)												99.4866	(43)
Daily hot water use	108.2281	105.9178	103.1040	98.8243	95.3493	91.6132	90.1768	92.9784	95.9333	99.8556	104.2013	107.9473	(44)
Energy conte	171.4068	150.8256	158.4670	135.2856	128.3585	112.6492	109.0610	115.1267	118.2954	135.5032	148.4538	169.0194	(45)
Energy content (annual)										Total = Sum(45)m =		1652.4520	
Distribution loss (46)m = 0.15 x (45)m	25.7110	22.6238	23.7701	20.2928	19.2538	16.8974	16.3591	17.2690	17.7443	20.3255	22.2681	25.3529	(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	222.3329	196.8233	209.3931	184.5689	179.2846	161.9324	159.9871	166.0528	167.5787	186.4292	197.7371	219.9454	(62)
WWHRS	-24.2527	-21.4493	-22.4605	-18.5982	-17.3328	-14.8318	-13.9025	-14.7839	-15.3456	-18.0907	-20.4946	-23.8036	(63a)
FV 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	198.0802	175.3740	186.9326	165.9707	161.9517	147.1006	146.0846	151.2689	152.2331	168.3385	177.2425	196.1418	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2026.7193	(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) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	97.7336	86.9477	93.4311	84.4091	83.4201	76.8825	77.0036	79.0205	78.7598	85.7957	88.7875	96.9398	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5724	83.6695	75.5724	78.0915	75.5724	78.0915	75.5724	75.5724	78.0915	75.5724	78.0915	75.5724	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	149.8308	151.3856	147.4676	139.1267	128.5978	118.7021	112.0911	110.5364	114.4543	122.7953	133.3242	143.2199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	(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)	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	(71)
Water heating gains (Table 5)													

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Total internal gains	131.3624	129.3864	125.5795	117.2348	112.1237	106.7812	103.4995	106.2103	109.3887	115.3167	123.3160	130.2954 (72)
	408.5592	416.2351	400.4131	386.2466	368.0875	352.3684	339.9566	341.1127	350.7281	365.4780	386.5253	400.8813 (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					1.2700	10.6334		0.6300	0.7000	0.7700		4.1271 (74)
East					4.3500	19.6403		0.6300	0.7000	0.7700		26.1101 (76)
South					1.7400	46.7521		0.6300	0.7000	0.7700		24.8612 (78)
West					5.3900	19.6403		0.6300	0.7000	0.7700		32.3525 (80)
Solar gains	87.4509	162.9686	253.6107	354.8337	426.7236	434.4409	414.5047	360.5934	289.3441	189.0089	107.4563	72.9997 (83)
Total gains	496.0101	579.2037	654.0238	741.0803	794.8111	786.8093	754.4613	701.7061	640.0722	554.4869	493.9816	473.8810 (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	23.5704	23.6494	23.7275	24.1009	24.1721	24.5090	24.5090	24.5725	24.3781	24.1721	24.0285	23.8802
alpha	2.5714	2.5766	2.5818	2.6067	2.6115	2.6339	2.6339	2.6382	2.6252	2.6115	2.6019	2.5920
util living area	0.9245	0.8911	0.8380	0.7401	0.6132	0.4668	0.3515	0.3889	0.5781	0.7861	0.8922	0.9314 (86)
MIT	18.6855	19.0467	19.5520	20.1615	20.6019	20.8623	20.9521	20.9365	20.7482	20.1556	19.3374	18.6388 (87)
Th 2	19.8492	19.8526	19.8559	19.8716	19.8745	19.8882	19.8882	19.8907	19.8829	19.8745	19.8686	19.8624 (88)
util rest of house	0.9133	0.8755	0.8152	0.7048	0.5621	0.3982	0.2688	0.3035	0.5085	0.7479	0.8742	0.9211 (89)
MIT 2	17.2048	17.6539	18.2762	19.0128	19.5115	19.7885	19.8641	19.8567	19.6845	19.0302	18.0352	17.1545 (90)
Living area fraction									fLA = Living area / (4) =			0.4922 (91)
MIT	17.9335	18.3393	18.9041	19.5782	20.0482	20.3170	20.3996	20.3881	20.2080	19.5841	18.6761	17.8850 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9335	18.3393	18.9041	19.5782	20.0482	20.3170	20.3996	20.3881	20.2080	19.5841	18.6761	17.8850 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8891	0.8503	0.7930	0.6947	0.5704	0.4254	0.3076	0.3427	0.5299	0.7367	0.8508	0.8977 (94)
Ext temp.	440.9978	492.4865	518.6148	514.8027	453.3748	334.7359	232.1029	240.5059	339.1604	408.5172	420.2771	425.4266 (95)
Heat loss rate W	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)
Space heating kWh	896.4716	880.7480	810.2288	686.6850	535.2676	361.5215	240.2713	251.5454	388.3239	576.0429	746.6715	888.1807 (97)
Space heating requirement - total per year (kWh/year)	338.8725	260.9117	216.9609	123.7552	60.9282	0.0000	0.0000	0.0000	0.0000	124.6391	235.0040	344.2890 (98a)
Solar heating kWh												1705.3606
Solar heating contribution - total per year (kWh/year)	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)
Space heating kWh	338.8725	260.9117	216.9609	123.7552	60.9282	0.0000	0.0000	0.0000	0.0000	124.6391	235.0040	344.2890 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1705.3606
Space heating per m2										(98c) / (4) =		33.4384 (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	338.8725	260.9117	216.9609	123.7552	60.9282	0.0000	0.0000	0.0000	0.0000	124.6391	235.0040	344.2890 (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)	367.1425	282.6779	235.0605	134.0793	66.0110	0.0000	0.0000	0.0000	0.0000	135.0370	254.6089	373.0109 (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	198.0802	175.3740	186.9326	165.9707	161.9517	147.1006	146.0846	151.2689	152.2331	168.3385	177.2425	196.1418 (64)
Efficiency of water heater (217)m	85.2531	84.9488	84.3947	83.4110	82.0740	79.8000	79.8000	79.8000	79.8000	83.3958	84.6932	79.8000 (216)
Fuel for water heating, kWh/month	232.3438	206.4466	221.4980	198.9794	197.3242	184.3366	183.0634	189.5601	190.7683	201.8549	209.2758	229.9217 (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	15.7025	12.5971	11.3423	8.3098	6.4188	5.2442	5.8554	7.6111	9.8860	12.9710	14.6507	16.1389 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-11.4095	-17.1704	-26.3311	-31.6603	-35.9859	-34.2884	-33.8875	-31.0736	-26.4389	-20.5269	-12.9278	-9.7429 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)												

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(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	-3.5253	-7.6263	-15.5541	-23.9504	-32.2454	-32.5964	-32.1971	-26.9826	-19.4263	-11.0796	-4.7626	-2.7713	(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												1847.6280	(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												2445.3727	(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)												126.7278	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-504.1606	(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												4001.5680	(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	1847.6280	0.2100	388.0019	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2445.3727	0.2100	513.5283	(264)
Space and water heating			901.5301	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	126.7278	0.1443	18.2907	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-291.4431	0.1332	-38.8270	
PV Unit electricity exported	-212.7174	0.1252	-26.6294	
Total			-65.4564	(269)
Total CO2, kg/year			866.2937	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			16.9900	(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	1847.6280	1.1300	2087.8196	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2445.3727	1.1300	2763.2711	(278)
Space and water heating			4851.0908	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	126.7278	1.5338	194.3794	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-291.4431	1.4923	-434.9183	
PV Unit electricity exported	-212.7174	0.4595	-97.7413	
Total			-532.6596	(283)
Total Primary energy kWh/year			4642.9114	(286)
Target Primary Energy Rate (TPER)			91.0400	(287)

ii. Be Lean

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Property Reference	6 Brownlow Road			Issued on Date	07/02/2024
Assessment Reference	Option 1 - Baseline Boiler - 1	Prop Type Ref	6 Brownlow Road		
Property	Daisy Court, 6 , Brownlow Road, LONDON, N11 2DE				
SAP Rating	78 C	DER	23.79	TER	15.65
Environmental	82 B	% DER < TER			-52.01
CO ₂ Emissions (t/year)	1.32	DFEE	58.27	TFEE	40.30
Compliance Check	See BREL	% DFEE < TFEE			-44.60
% DPER < TPER	-58.61	DPER	132.66	TPER	83.64
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7000 (1b)	2.5000 (2b)	154.2500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7000		154.2500 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 154.2500 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1297 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3797 (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) = 0.3797 (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	0.4841	0.4746	0.4651	0.4176	0.4081	0.3607	0.3607	0.3512	0.3797	0.4081	0.4271	0.4461 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5650	0.5650	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

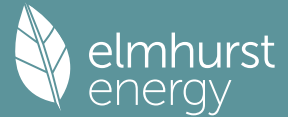
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
PROPOSED (Uw = 1.60)			22.0100	1.5038	33.0977		(27)
EXTERNAL	62.7800	22.0100	40.7700	0.2800	11.4156	18.0000	733.8600 (29a)
HALLWAY	16.8000		16.8000	0.2500	4.2000	18.0000	302.4000 (29a)
FLAT ROOF	61.7000		61.7000	0.1300	8.0210	9.0000	555.3000 (30)
Total net area of external elements Aum(A, m ²)			141.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.3743		(33)
PARTY WALL			11.2800	0.5000	5.6400	140.0000	1579.2000 (32)
PARTY FLOOR			61.7000			40.0000	2468.0000 (32d)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 5638.7600 (34)
91.3900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.5800	0.3000	3.4740
E3 Sill	5.9500	0.0400	0.2380
E4 Jamb	25.4000	0.0500	1.2700
E7 Party floor between dwellings (in blocks of flats)	25.1100	0.0700	1.7577
E14 Flat roof	25.1100	0.0400	1.0044
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250

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E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.1200	0.3000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.2200	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.1691 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	71.5434 (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	31.4150	31.1834	30.9564	29.8902	29.6908	28.7621	28.7621	28.5902	29.1198	29.6908	30.0943	30.5162 (38)
Heat transfer coeff												
	102.9584	102.7269	102.4999	101.4337	101.2342	100.3056	100.3056	100.1336	100.6633	101.2342	101.6377	102.0596 (39)
Average = Sum(39)m / 12 =												101.4327
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.6687	1.6649	1.6613	1.6440	1.6407	1.6257	1.6257	1.6229	1.6315	1.6407	1.6473	1.6541 (40)
HLP (average)												1.6440
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0293 (42)
Hot water usage for mixer showers													58.0206 (42a)
Hot water usage for baths													26.4051 (42b)
Hot water usage for other uses													37.2755 (42c)
Average daily hot water use (litres/day)													112.1504 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	122.0140	119.3897	116.2047	111.3871	107.4657	103.2536	101.6538	104.8253	108.1675	112.5870	117.4780	121.7012	(44)
Energy content (annual)	193.2403	170.0094	178.6023	152.4834	144.6695	126.9623	122.9415	129.7956	133.3813	152.7795	167.3690	190.5547	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =			1862.7888
Water storage loss:	28.9860	25.5014	26.7903	22.8725	21.7004	19.0443	18.4412	19.4693	20.0072	22.9169	25.1053	28.5832	(46)
Total storage loss													
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	(56)
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	(57)
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	(59)
Total heat required for water heating calculated for each month													
WWHRS	244.1992	216.0368	229.5612	201.7985	195.6284	176.2774	173.9004	180.7545	182.6964	203.7384	216.6840	241.5136	(62)
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	(63a)
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	(63b)
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	(63c)
Output from w/h	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)
	244.1992	216.0368	229.5612	201.7985	195.6284	176.2774	173.9004	180.7545	182.6964	203.7384	216.6840	241.5136	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2462.7888	(64)
Electric shower(s)												2463	(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													
	76.9921	68.0350	72.1250	63.0295	60.8423	54.5437	53.6178	55.8968	56.6780	63.5389	67.9790	76.0992	(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	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.3837	98.9605	89.3837	92.3631	89.3837	92.3631	89.3837	89.3837	92.3631	89.3837	92.3631	89.3837 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.2131	179.0520	174.4180	164.5527	152.0996	140.3954	132.5763	130.7374	135.3714	145.2367	157.6898	169.3940 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463 (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)	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708 (71)
Water heating gains (Table 5)	103.4840	101.2425	96.9422	87.5410	81.7773	75.7552	72.0669	75.1301	78.7195	85.4018	94.4152	102.2838 (72)
Total internal gains	426.5199	435.6941	417.1829	400.8959	379.6997	361.9528	347.4659	348.6902	359.8931	376.4612	400.9072	417.5005 (73)

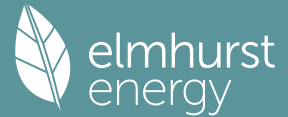
6. Solar gains

[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				5.8100	10.6334		0.6300		0.7000		0.7700		18.8808 (74)
East				7.7300	19.6403		0.6300		0.7000		0.7700		46.3979 (76)
West				8.4700	19.6403		0.6300		0.7000		0.7700		50.8396 (80)
Solar gains	116.1184	226.2995	374.5732	555.3556	692.5802	715.1948	678.2795	573.9320	438.0527	268.6600	144.5357	95.7034	83)
Total gains	542.6382	661.9935	791.7561	956.2515	1072.2799	1077.1475	1025.7454	922.6222	797.9458	645.1211	545.4429	513.2039	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	

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tau	15.2132	15.2474	15.2812	15.4418	15.4723	15.6155	15.6155	15.6423	15.5600	15.4723	15.4108	15.3471
alpha	2.0142	2.0165	2.0187	2.0295	2.0315	2.0410	2.0410	2.0428	2.0373	2.0315	2.0274	2.0231
util living area	0.9308	0.8990	0.8459	0.7491	0.6257	0.4904	0.3828	0.4305	0.6233	0.8149	0.9055	0.9373 (86)
MIT	17.4430	17.8949	18.6028	19.4915	20.2005	20.6622	20.8554	20.8114	20.4154	19.4423	18.2903	17.3700 (87)
Th 2	19.5634	19.5661	19.5687	19.5812	19.5836	19.5945	19.5945	19.5966	19.5903	19.5836	19.5788	19.5739 (88)
util rest of house	0.9199	0.8835	0.8222	0.7107	0.5677	0.4073	0.2755	0.3198	0.5428	0.7764	0.8883	0.9274 (89)
MIT 2	16.4223	16.8629	17.5470	18.3892	19.0240	19.4097	19.5419	19.5221	19.2359	18.3761	17.2674	16.3572 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	16.8640	17.3095	18.0039	18.8662	19.5331	19.9517	20.1103	20.0800	19.7463	18.8375	17.7101	16.7955 (92)
Temperature adjustment												0.0000
adjusted MIT	16.8640	17.3095	18.0039	18.8662	19.5331	19.9517	20.1103	20.0800	19.7463	18.8375	17.7101	16.7955 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8912	0.8511	0.7898	0.6883	0.5654	0.4298	0.3168	0.3602	0.5527	0.7515	0.8579	0.9000 (94)
Useful gains	483.5799	563.4499	625.3449	658.2241	606.2950	462.9249	324.9721	332.3371	441.0014	484.7820	467.9096	461.9005 (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	1293.5676	1274.7882	1179.1454	1010.9064	792.9782	536.8084	352.0988	368.4966	568.3797	833.9149	1078.3826	1285.4889 (97)
Space heating kWh	602.6308	478.0194	412.0276	253.9312	138.8923	0.0000	0.0000	0.0000	0.0000	259.7549	439.5405	612.7498 (98a)
Space heating requirement - total per year (kWh/year)												3197.5465
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	602.6308	478.0194	412.0276	253.9312	138.8923	0.0000	0.0000	0.0000	0.0000	259.7549	439.5405	612.7498 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3197.5465
Space heating per m2										(98c) / (4) =		51.8241 (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	602.6308	478.0194	412.0276	253.9312	138.8923	0.0000	0.0000	0.0000	0.0000	259.7549	439.5405	612.7498 (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)	716.5646	568.3940	489.9258	301.9396	165.1513	0.0000	0.0000	0.0000	0.0000	308.8643	522.6403	728.5967 (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	244.1992	216.0368	229.5612	201.7985	195.6284	176.2774	173.9004	180.7545	182.6964	203.7384	216.6840	241.5136 (64)
Efficiency of water heater (217)m	86.4371	86.2325	85.8196	85.0754	83.8607	80.5000	80.5000	80.5000	80.5000	85.1035	86.0640	80.5000 (216)
Fuel for water heating, kWh/month	282.5166	250.5283	267.4928	237.1995	233.2777	218.9781	216.0253	224.5398	226.9520	239.4008	251.7708	279.2459 (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	7.0685	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	36.3566	29.1666	26.2613	19.2402	14.8616	12.1421	13.5573	17.6223	22.8896	30.0324	33.9215	37.3671 (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												3802.0767 (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												2927.9275 (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)												293.4185 (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)

Full SAP Calculation Printout



Total delivered energy for all uses

7109.4227 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	3802.0767	0.2100	798.4361	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)	2927.9275	0.2100	614.8648	(264)
Space and water heating			1413.3009	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	293.4185	0.1443	42.3494	(268)
Total CO ₂ , kg/year			1467.5795	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			23.7900	(273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year	
Space heating - main system 1	3802.0767	1.1300	4296.3466	(275)
Total CO ₂ associated with community systems			0.0000	(473)
Water heating (other fuel)	2927.9275	1.1300	3308.5581	(278)
Space and water heating			7604.9047	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	293.4185	1.5338	450.0551	(282)
Total Primary energy kWh/year			8185.0606	(286)
Dwelling Primary energy Rate (DPER)			132.6600	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	61.7000 (1b)	x 2.5000 (2b)	= 154.2500 (1b) - (3b)	(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7000			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.2500 (5)	

2. Ventilation rate

	m ³ 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)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1297 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3797	(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) =		0.3797 (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	0.4841	0.4746	0.4651	0.4176	0.4081	0.3607	0.3607	0.3512	0.3797	0.4081	0.4271	0.4461	(22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5650	0.5650	0.5617	0.5721	0.5833	0.5912	0.5995	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opening Type (U _w = 1.20)			15.4300	1.1450	17.6679			(27)
EXTERNAL	62.7800	15.4300	47.3500	0.1800	8.5230			(29a)
HALLWAY	16.8000		16.8000	0.1800	3.0240			(29a)
FLAT ROOF	61.7000		61.7000	0.1100	6.7870			(30)
Total net area of external elements A _{um} (A, m ²)			141.2800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0019			(33)
PARTY WALL			11.2800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							91.3900	(35)
List of Thermal Bridges								

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$												
(38)m	Jan 31.4150	Feb 31.1834	Mar 30.9564	Apr 29.8902	May 29.6908	Jun 28.7621	Jul 28.7621	Aug 28.5902	Sep 29.1198	Oct 29.6908	Nov 30.0943	Dec 30.5162 (38)
Heat transfer coeff	74.6049	74.3733	74.1464	73.0802	72.8807	71.9521	71.9521	71.7801	72.3098	72.8807	73.2842	73.7061 (39)
Average = Sum(39)m / 12 =												73.0792
HLP	Jan 1.2092	Feb 1.2054	Mar 1.2017	Apr 1.1844	May 1.1812	Jun 1.1662	Jul 1.1662	Aug 1.1634	Sep 1.1720	Oct 1.1812	Nov 1.1878	Dec 1.1946 (40)
HLP (average)												1.1844
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												2.0293 (42)
Hot water usage for mixer showers	58.2438	57.3685	56.0930	53.6526	51.8517	49.8433	48.7017	49.9675	51.3551	53.5115	56.0043	58.0206 (42a)
Hot water usage for baths	25.1700	24.7961	24.2697	23.2992	22.5724	21.7665	21.3312	21.8539	22.4231	23.2854	24.2760	25.0849 (42b)
Hot water usage for other uses	35.4117	34.1240	32.8363	31.5486	30.2609	28.9732	28.9732	30.2609	31.5486	32.8363	34.1240	35.4117 (42c)
Average daily hot water use (litres/day)												109.2278 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	118.8255	116.2887	113.1991	108.5004	104.6850	100.5831	99.0062	102.0824	105.3268	109.6333	114.4043	118.5172 (44)
Distribution loss (46)m = 0.15 x (45)m	188.1905	165.5935	173.9828	148.5316	140.9261	123.6786	119.7394	126.3994	129.8785	148.7713	162.9899	185.5693 (45)
Total = Sum(45)m =												1814.2510
Water storage loss:	28.2286	24.8390	26.0974	22.2797	21.1389	18.5518	17.9609	18.9599	19.4818	22.3157	24.4485	27.8354 (46)
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	50.4525	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	239.1494	211.6209	224.9417	197.8467	191.8851	172.9937	170.1919	177.3583	179.1936	199.7302	212.3050	236.5282 (62)
WWHRS	-26.6266	-23.5488	-24.6589	-20.4186	-19.0294	-16.2836	-15.2633	-16.2309	-16.8476	-19.8615	-22.5006	-26.1335 (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	212.5228	188.0721	200.2827	177.4281	172.8557	156.7101	154.9286	161.1273	162.3460	179.8687	189.8044	210.3947 (64)
12Total per year (kWh/year)												2166.3412 (64a)
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)
Heat gains from water heating, kWh/month	75.3131	66.5667	70.5890	61.7155	59.5977	53.4519	52.4265	54.7675	55.5134	62.2062	66.5229	74.4415 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.3837	98.9605	89.3837	92.3631	89.3837	92.3631	89.3837	89.3837	92.3631	89.3837	92.3631	89.3837 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.2131	179.0520	174.4180	164.5527	152.0996	140.3954	132.5763	130.7374	135.3714	145.2367	157.6898	169.3940 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463 (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)	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708 (71)
Water heating gains (Table 5)	101.2272	99.0576	94.8777	85.7160	80.1044	74.2388	70.4657	73.6123	77.1019	83.6105	92.3929	100.0558 (72)
Total internal gains	424.2630	433.5091	415.1184	399.0709	378.0267	360.4364	345.8647	347.1724	358.2755	374.6699	398.8849	415.2725 (73)

[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				4.0700	10.6334		0.6300		0.7000		0.7700		13.2263 (74)
East				5.4200	19.6403		0.6300		0.7000		0.7700		32.5326 (76)
West				5.9400	19.6403		0.6300		0.7000		0.7700		35.6538 (80)
Solar gains	81.4126	158.6631	262.6197	389.3638	485.5659	501.4173	475.5378	402.3854	307.1247	188.3628	101.3367	67.0992 (83)	
Total gains	505.6757	592.1722	677.7381	788.4348	863.5926	861.8536	821.4025	749.5578	665.4002	563.0327	500.2216	482.3717 (84)	

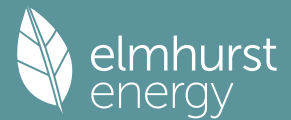
elmhurst
energy

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	20.9949	21.0603	21.1247	21.4329	21.4916	21.7690	21.7690	21.8211	21.6613	21.4916	21.3732	21.2509
alpha	2.3997	2.4040	2.4083	2.4289	2.4328	2.4513	2.4513	2.4547	2.4441	2.4328	2.4249	2.4167
util living area	0.9284	0.8977	0.8465	0.7478	0.6190	0.4738	0.3617	0.4055	0.6023	0.8049	0.9006	0.9349 (86)
MIT	18.3509	18.7252	19.2847	19.9856	20.5063	20.8194	20.9323	20.9090	20.6605	19.9497	19.0466	18.2997 (87)
Th 2	19.9127	19.9157	19.9186	19.9325	19.9351	19.9472	19.9472	19.9494	19.9425	19.9351	19.9298	19.9243 (88)
util rest of house	0.9188	0.8845	0.8267	0.7162	0.5723	0.4099	0.2828	0.3236	0.5383	0.7723	0.8855	0.9261 (89)
MIT 2	16.8474	17.3159	18.0106	18.8655	19.4667	19.8074	19.9092	19.8952	19.6574	18.8493	17.7359	16.7898 (90)
Living area fraction									fLA =	Living area / (4) =		0.4327 (91)
MIT	17.4980	17.9258	18.5620	19.3502	19.9166	20.2453	20.3520	20.3339	20.0915	19.3255	18.3031	17.4432 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4980	17.9258	18.5620	19.3502	19.9166	20.2453	20.3520	20.3339	20.0915	19.3255	18.3031	17.4432 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8903	0.8535	0.7969	0.6970	0.5715	0.4287	0.3139	0.3546	0.5480	0.7504	0.8561	0.8988 (94)
Useful gains	450.2118	505.4344	540.0717	549.5285	493.5247	369.4837	257.8529	265.7827	364.6257	422.5271	428.2543	433.5599 (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	984.6394	968.7722	894.3499	763.7026	598.8312	406.1911	269.9616	282.3750	433.2421	635.9184	821.0107	976.1050 (97)
Space heating kWh	397.6141	311.3630	263.5830	154.2054	78.3480	0.0000	0.0000	0.0000	0.0000	158.7632	282.7845	403.6536 (98a)
Space heating requirement - total per year (kWh/year)												2050.3148
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	397.6141	311.3630	263.5830	154.2054	78.3480	0.0000	0.0000	0.0000	0.0000	158.7632	282.7845	403.6536 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2050.3148
Space heating per m2											(98c) / (4) =	33.2304 (99)

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	397.6141	311.3630	263.5830	154.2054	78.3480	0.0000	0.0000	0.0000	0.0000	158.7632	282.7845	403.6536	(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)	430.3183	336.9729	285.2630	166.8890	84.7922	0.0000	0.0000	0.0000	0.0000	171.8216	306.0439	436.8545	(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 requirement	212.5228	188.0721	200.2827	177.4281	172.8557	156.7101	154.9286	161.1273	162.3460	179.8687	189.8044	210.3947	(64)
Efficiency of water heater (217)m	85.7029	85.4537	84.9708	84.0822	82.7982	80.3000	80.3000	80.3000	80.3000	84.1150	85.2338	85.7532	(216)
Fuel for water heating, kWh/month	247.9762	220.0867	235.7077	211.0175	208.7675	195.1558	192.9373	200.6567	202.1743	213.8367	222.6868	245.3490	(217)
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	18.5722	14.8993	13.4151	9.8285	7.5918	6.2026	6.9255	9.0020	11.6928	15.3415	17.3282	19.0883	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-13.7324	-20.6272	-31.5699	-37.8756	-42.9663	-40.8971	-40.4073	-37.0864	-31.6135	-24.6139	-15.5428	-11.7299	(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	-4.3358	-9.3719	-19.1030	-29.4024	-39.5802	-40.0204	-39.5422	-33.1501	-23.8744	-13.6237	-5.8592	-3.4098	(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												2218.9554	(211)
Space heating fuel - main system 2													

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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	4441.2602 (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	2218.9554	0.2100	465.9806 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2596.3522	0.2100	545.2340 (264)
Space and water heating			1011.2146 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	149.8880	0.1443	21.6335 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-348.6623	0.1333	-46.4665
PV Unit electricity exported	-261.2731	0.1252	-32.7091
Total			-79.1756 (269)
Total CO2, kg/year			965.6017 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.6500 (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	2218.9554	1.1300	2507.4196 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2596.3522	1.1300	2933.8780 (278)
Space and water heating			5441.2976 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	149.8880	1.5338	229.9032 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-348.6623	1.4925	-520.3684
PV Unit electricity exported	-261.2731	0.4595	-120.0561
Total			-640.4246 (283)
Total Primary energy kWh/year			5160.8770 (286)
Target Primary Energy Rate (TPER)			83.6400 (287)

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Property Reference	6 Brownlow Road			Issued on Date	07/02/2024
Assessment Reference	Option 1 - Baseline Boiler - 2	Prop Type Ref	6 Brownlow Road		
Property	Daisy Court, 6 , Brownlow Road, LONDON, N11 2DE				
SAP Rating	78 C	DER	26.18	TER	17.21
Environmental	82 B	% DER < TER			-52.12
CO ₂ Emissions (t/year)	1.2	DFEE	63.66	TFEE	42.47
Compliance Check	See BREL	% DFEE < TFEE			-49.87
% DPER < TPER	-58.09	DPER	145.85	TPER	92.26
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.0000 (1b)	2.5000 (2b)	127.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	127.5000 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1569 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4069 (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) = 0.4069 (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	0.5187	0.5086	0.4984	0.4475	0.4374	0.3865	0.3865	0.3763	0.4069	0.4374	0.4577	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5956	0.5747	0.5747	0.5708	0.5828	0.5956	0.6048	0.6143 (25)

3. Heat losses and heat loss parameter

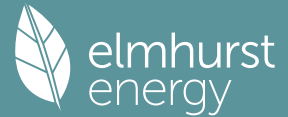
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
PROPOSED (Uw = 1.60)			20.0400	1.5038	30.1353		(27)
EXTERNAL	64.1000	20.0400	44.0600	0.2800	12.3368	18.0000	793.0800 (29a)
HALLWAY	14.2800		14.2800	0.2500	3.5700	18.0000	257.0400 (29a)
FLAT ROOF	51.0000		51.0000	0.1300	6.6300	9.0000	459.0000 (30)
Total net area of external elements Aum(A, m ²)			129.3800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.3121		(33)
PARTY WALL			11.2800	0.5000	5.6400	180.0000	2030.4000 (32)
PARTY FLOOR			51.0000			40.0000	2040.0000 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5579.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 109.4024 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.4500	0.3000	3.1350
E3 Sill	4.2000	0.0400	0.1680
E4 Jamb	23.6000	0.0500	1.1800
E7 Party floor between dwellings (in blocks of flats)	25.6400	0.0700	1.7948
E14 Flat roof	25.6400	0.0400	1.0256
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250

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E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.1200	0.3000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.2300	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.7284 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	67.0405 (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	
26.6987	26.4789	26.2634	25.2513	25.0620	24.1804	24.1804	24.0172	24.5200	25.0620	25.4450	25.8455	(38)
(38)m												
Heat transfer coeff	93.7393	93.5194	93.3040	92.2919	92.1025	91.2210	91.2210	91.0577	91.5605	92.1025	92.4856	92.8861 (39)
Average = Sum(39)m / 12 =												92.2909
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.8380	1.8337	1.8295	1.8096	1.8059	1.7886	1.7886	1.7854	1.7953	1.8059	1.8134	1.8213 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7196 (42)
Hot water usage for mixer showers												
53.0510	52.2538	51.0920	48.8692	47.2288	45.3995	44.3597	45.5127	46.7765	48.7407	51.0112	52.8478	(42a)
Hot water usage for baths												
24.1441	23.7855	23.2806	22.3496	21.6524	20.8794	20.4618	20.9633	21.5092	22.3364	23.2866	24.0625	(42b)
Hot water usage for other uses												
33.9370	32.7029	31.4688	30.2348	29.0007	27.7666	27.7666	29.0007	30.2348	31.4688	32.7029	33.9370	(42c)
Average daily hot water use (litres/day)												102.1485 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
111.1321	108.7422	105.8415	101.4536	97.8820	94.0455	92.5882	95.4766	98.5205	102.5459	107.0007	110.8473	(44)
Energy conte	176.0061	154.8475	162.6744	138.8848	131.7679	115.6399	111.9774	118.2200	121.4857	139.1538	152.4422	173.5600 (45)
Energy content (annual)										Total = Sum(45)m =		1696.6598
Distribution loss (46)m = 0.15 x (45)m												
26.4009	23.2271	24.4012	20.8327	19.7652	17.3460	16.7966	17.7330	18.2228	20.8731	22.8663	26.0340	(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	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.8796	46.3786	47.1819	48.6538	48.5855	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
226.9651	200.8749	213.6333	188.1999	181.6475	162.0186	159.1593	166.8739	170.0711	190.1127	201.7572	224.5189	(62)
WWHRS	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	(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	(63c)
FGHRS	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	226.9651	200.8749	213.6333	188.1999	181.6475	162.0186	159.1593	166.8739	170.0711	190.1127	201.7572	224.5189 (64)
12Total per year (kWh/year)												2285.8324 (64)
Electric shower(s)												2286 (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												
71.2618	62.9936	66.8290	58.5080	56.2827	50.0449	49.0280	51.4716	52.5403	59.0084	63.0158	70.4484	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
75.5724	83.6695	75.5724	78.0915	75.5724	78.0915	75.5724	75.5724	75.5724	78.0915	75.5724	78.0915	75.5724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
149.8308	151.3856	147.4676	139.1267	128.5978	118.7021	112.0911	110.5364	114.4543	122.7953	133.3242	143.2199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	(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)												
-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	(71)
Water heating gains (Table 5)												
95.7819	93.7405	89.8239	81.2611	75.6488	69.5069	65.8978	69.1823	72.9727	79.3123	87.5219	94.6888	(72)
Total internal gains	372.9787	380.5892	364.6575	350.2728	331.6126	315.0940	302.3549	304.0846	314.3121	329.4736	350.7312	365.2746 (73)

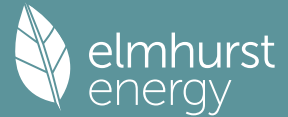
6. Solar gains

[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			2.0000	10.6334	0.6300	0.7000	0.7700	6.4994 (74)				
East			6.8400	19.6403	0.6300	0.7000	0.7700	41.0559 (76)				
South			2.7300	46.7521	0.6300	0.7000	0.7700	39.0063 (78)				
West			8.4700	19.6403	0.6300	0.7000	0.7700	50.8396 (80)				
Solar gains	137.4013	256.0702	398.5314	557.6450	670.6613	682.8045	651.4652	566.7110	454.7010	296.9972	168.8366	114.6937 (83)
Total gains	510.3800	636.6593	763.1889	907.9178	1002.2738	997.8985	953.8201	870.7956	769.0131	626.4707	519.5678	479.9683 (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)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	16.5338	16.5727	16.6109	16.7931	16.8276	16.9902	16.9902	17.0207	16.9272	16.8276	16.7579	16.6857
alpha	2.1023	2.1048	2.1074	2.1195	2.1218	2.1327	2.1327	2.1347	2.1285	2.1218	2.1172	2.1124
util living area	0.9341	0.8987	0.8431	0.7466	0.6250	0.4899	0.3796	0.4228	0.6115	0.8086	0.9070	0.9411 (86)
MIT	17.6383	18.1143	18.8043	19.6343	20.2831	20.7030	20.8770	20.8413	20.4955	19.5945	18.4689	17.5610 (87)
Th 2	19.4435	19.4465	19.4494	19.4633	19.4659	19.4780	19.4780	19.4802	19.4733	19.4659	19.4606	19.4551 (88)
util rest of house	0.9222	0.8811	0.8160	0.7033	0.5602	0.3980	0.2623	0.3021	0.5214	0.7643	0.8876	0.9304 (89)
MIT 2	16.5136	16.9753	17.6374	18.4166	18.9871	19.3282	19.4393	19.4256	19.1891	18.4138	17.3409	16.4453 (90)
Living area fraction									FLA = Living area / (4) =			0.4922 (91)
MIT	17.0672	17.5359	18.2117	19.0159	19.6249	20.0048	20.1469	20.1223	19.8320	18.9949	17.8961	16.9944 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0672	17.5359	18.2117	19.0159	19.6249	20.0048	20.1469	20.1223	19.8320	18.9949	17.8961	16.9944 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8971	0.8530	0.7894	0.6889	0.5676	0.4316	0.3161	0.3558	0.5447	0.7479	0.8616	0.9066 (94)
Useful gains	457.8519	543.0546	602.4866	625.4397	568.8512	430.7382	301.4887	309.8135	418.8549	468.5074	447.6800	435.1529 (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	1196.7835	1181.7007	1092.7476	933.6195	729.9055	493.0317	323.5477	338.9470	524.8286	773.1913	998.4788	1188.4195 (97)
Space heating kWh	549.7651	429.1702	364.7542	221.8895	119.8244	0.0000	0.0000	0.0000	0.0000	226.6849	396.5752	560.4304 (98a)
Space heating requirement - total per year (kWh/year)												2869.0938
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	549.7651	429.1702	364.7542	221.8895	119.8244	0.0000	0.0000	0.0000	0.0000	226.6849	396.5752	560.4304 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2869.0938
Space heating per m2										(98c) / (4) =		56.2567 (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	549.7651	429.1702	364.7542	221.8895	119.8244	0.0000	0.0000	0.0000	0.0000	226.6849	396.5752	560.4304 (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)	653.7041	510.3094	433.7149	263.8401	142.4784	0.0000	0.0000	0.0000	0.0000	269.5420	471.5519	666.3857 (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	226.9651	200.8749	213.6333	188.1999	181.6475	162.0186	159.1593	166.8739	170.0711	190.1127	201.7572	224.5189 (64)
Efficiency of water heater (217)m	86.4028	86.1651	85.7176	84.9358	83.7115	80.5000	80.5000	80.5000	80.5000	84.9600	86.0019	86.4581 (217)
Fuel for water heating, kWh/month	262.6826	233.1278	249.2292	221.5791	216.9924	201.2653	197.7134	207.2967	211.2685	223.7674	234.5963	259.6853 (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	30.7389	24.6599	22.2035	16.2672	12.5653	10.2659	11.4625	14.8994	19.3528	25.3919	28.6801	31.5932 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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)	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												3411.5265 (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												2719.2039 (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)												248.0806 (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)

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Energy used 0.0000 (237)
Total delivered energy for all uses 6464.8110 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3411.5265	0.2100	716.4206 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	2719.2039	0.2100	571.0328 (264)
Space and water heating			1287.4534 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	248.0806	0.1443	35.8057 (268)
Total CO ₂ , kg/year			1335.1883 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			26.1800 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	3411.5265	1.1300	3855.0249 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	2719.2039	1.1300	3072.7005 (278)
Space and water heating			6927.7254 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	248.0806	1.5338	380.5143 (282)
Total Primary energy kWh/year			7438.3405 (286)
Dwelling Primary energy Rate (DPER)			145.8500 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.0000 (1b)	x 2.5000 (2b)	= 127.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.5000 (5)

2. Ventilation rate

	m ³ 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)

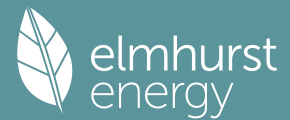
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1569 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4069	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4069	(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	0.5187	0.5086	0.4984	0.4475	0.4374	0.3865	0.3865	0.3763	0.4069	0.4374	0.4577	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5956	0.5747	0.5747	0.5708	0.5828	0.5956	0.6048	0.6143 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (U _w = 1.20)			12.7500	1.1450	14.5992		(27)
EXTERNAL	64.1000		51.3500	0.1800	9.2430		(29a)
HALLWAY	14.2800		14.2800	0.1800	2.5704		(29a)
FLAT ROOF	51.0000		51.0000	0.1100	5.6100		(30)
Total net area of external elements A _{um} (A, m ²)			129.3800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0226		(33)
PARTY WALL			11.2800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							109.4024 (35)

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List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.4500	0.0500	0.5225
E3 Sill	4.2000	0.0500	0.2100
E4 Jamb	23.6000	0.0500	1.1800
E7 Party floor between dwellings (in blocks of flats)	25.6400	0.0700	1.7948
E14 Flat roof	25.6400	0.0800	2.0512
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.0600	0.1500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.2300	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.0335 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			39.0561 (37) (33) + (36) + (36a) =

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	26.6987	26.4789	26.2634	25.2513	25.0620	24.1804	24.1804	24.0172	24.5200	25.0620	25.4450	25.8455 (38)
Average = Sum(39)m / 12 =	65.7549	65.5350	65.3195	64.3075	64.1181	63.2366	63.2366	63.0733	63.5761	64.1181	64.5012	64.9017 (39)
												64.3065
HLP	1.2893	1.2850	1.2808	1.2609	1.2572	1.2399	1.2399	1.2367	1.2466	1.2572	1.2647	1.2726 (40)
HLP (average)												1.2609
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7196 (42)
Hot water usage for mixer showers												
53.0510	52.2538	51.0920	48.8692	47.2288	45.3995	44.3597	45.5127	46.7765	48.7407	51.0112	52.8478 (42a)	
Hot water usage for baths												
22.9369	22.5963	22.1166	21.2321	20.5698	19.8354	19.4388	19.9151	20.4338	21.2196	22.1223	22.8594 (42b)	
Hot water usage for other uses												
32.2401	31.0678	29.8954	28.7230	27.5507	26.3783	26.3783	27.5507	28.7230	29.8954	31.0678	32.2401 (42c)	
Average daily hot water use (litres/day)												99.4866 (43)
Daily hot water use												
108.2281	105.9178	103.1040	98.8243	95.3493	91.6132	90.1768	92.9784	95.9333	99.8556	104.2013	107.9473 (44)	
Energy content (annual)	171.4068	150.8256	158.4670	135.2856	128.3585	112.6492	109.0610	115.1267	118.2954	135.5032	148.4538	169.0194 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1652.4520
25.7110	22.6238	23.7701	20.2928	19.2538	16.8974	16.3591	17.2690	17.7443	20.3255	22.2681	25.3529 (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 (59)	
Combi loss	50.9589	46.0274	50.9589	48.7353	48.5890	45.1791	45.9531	47.3808	47.3096	50.8853	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
222.3657	196.8530	209.4259	184.0209	176.9474	157.8283	155.0141	162.5075	165.6050	186.3885	197.7689	219.9783 (62)	
WWHRS	-24.2527	-21.4493	-22.4605	-18.5982	-17.3328	-14.8318	-13.9025	-14.7839	-15.3456	-18.0907	-20.4946	-23.8036 (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												
198.1130	175.4037	186.9654	165.4227	159.6146	142.9965	141.1116	147.7236	150.2594	168.2978	177.2743	196.1747 (64)	
12Total per year (kWh/year)												2009.3572 (64)
Electric shower(s)												2009 (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												
69.7325	61.6563	65.4300	57.1663	54.8264	48.7506	47.7510	50.1248	51.1606	57.7761	61.6897	68.9387 (65)	

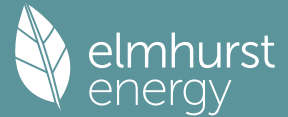
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.5724	83.6695	75.5724	78.0915	75.5724	78.0915	75.5724	75.5724	78.0915	75.5724	78.0915	75.5724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	149.8308	151.3856	147.4676	139.1267	128.5978	118.7021	112.0911	110.5364	114.4543	122.7953	133.3242	143.2199 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979 (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)	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828 (71)
Water heating gains (Table 5)	93.7265	91.7505	87.9436	79.3976	73.6914	67.7092	64.1815	67.3721	71.0564	77.6561	85.6801	92.6595 (72)
Total internal gains	370.9233	378.5991	362.7771	348.4094	329.6552	313.2963	300.6386	302.2744	312.3958	327.8173	348.8893	363.2454 (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				1.2700	10.6334		0.6300		0.7000		0.7700		4.1271 (74)
East				4.3500	19.6403		0.6300		0.7000		0.7700		26.1101 (76)
South				1.7400	46.7521		0.6300		0.7000		0.7700		24.8612 (78)
West				5.3900	19.6403		0.6300		0.7000		0.7700		32.3525 (80)
Solar gains	87.4509	162.9686	253.6107	354.8337	426.7236	434.4409	414.5047	360.5934	289.3441	189.0089	107.4563		72.9997 (83)

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Total gains 458.3742 541.5677 616.3878 703.2431 756.3788 747.7372 715.1433 662.8678 601.7399 516.8262 456.3456 436.2451 (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	23.5704	23.6494	23.7275	24.1009	24.1721	24.5090	24.5090	24.5725	24.3781	24.1721	24.0285	23.8802
alpha	2.5714	2.5766	2.5818	2.6067	2.6115	2.6339	2.6339	2.6382	2.6252	2.6115	2.6019	2.5920
util living area	0.9355	0.9039	0.8533	0.7582	0.6328	0.4860	0.3686	0.4084	0.6027	0.8078	0.9071	0.9420 (86)
MIT	18.5778	18.9502	19.4717	20.1057	20.5698	20.8482	20.9463	20.9286	20.7211	20.0884	19.2398	18.5282 (87)
Th 2	19.8492	19.8526	19.8559	19.8716	19.8745	19.8882	19.8882	19.8907	19.8829	19.8745	19.8686	19.8624 (88)
util rest of house	0.9257	0.8897	0.8319	0.7239	0.5817	0.4159	0.2827	0.3198	0.5327	0.7717	0.8911	0.9331 (89)
MIT 2	17.0715	17.5364	18.1812	18.9510	19.4799	19.7775	19.8610	19.8521	19.6610	18.9559	17.9172	17.0171 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.8128	18.2322	18.8163	19.5193	20.0163	20.3045	20.3951	20.3819	20.1828	19.5133	18.5681	17.7608 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.8128	18.2322	18.8163	19.5193	20.0163	20.3045	20.3951	20.3819	20.1828	19.5133	18.5681	17.7608 (93)

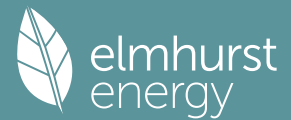
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9026	0.8647	0.8088	0.7121	0.5886	0.4430	0.3228	0.3602	0.5526	0.7584	0.8678	0.9111 (94)
Useful gains	413.7131	468.2894	498.5282	500.7457	445.1777	331.2735	230.8302	238.7341	332.5155	391.9632	396.0024	397.4513 (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	888.5340	873.7278	804.4979	682.9017	533.2247	360.7312	239.9907	251.1522	386.7188	571.5019	739.7082	880.1194 (97)
Space heating kWh	353.2667	272.4546	227.6414	131.1523	65.5070	0.0000	0.0000	0.0000	0.0000	133.5768	247.4682	359.1051 (98a)
Space heating requirement - total per year (kWh/year)	1790.1723											
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	353.2667	272.4546	227.6414	131.1523	65.5070	0.0000	0.0000	0.0000	0.0000	133.5768	247.4682	359.1051 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1790.1723											
Space heating per m2	(98c) / (4) = 35.1014 (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	353.2667	272.4546	227.6414	131.1523	65.5070	0.0000	0.0000	0.0000	0.0000	133.5768	247.4682	359.1051 (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)	382.3233	294.8643	246.3652	141.9398	70.8950	0.0000	0.0000	0.0000	0.0000	144.5636	267.8227	388.6419 (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	198.1130	175.4037	186.9654	165.4227	159.6146	142.9965	141.1116	147.7236	150.2594	168.2978	177.2743	196.1747 (64)
Efficiency of water heater (217)m	85.6058	85.3212	84.8043	83.8887	82.6259	80.3000	80.3000	80.3000	80.3000	83.8910	85.0962	80.3000 (216)
Fuel for water heating, kWh/month	231.4247	205.5804	220.4669	197.1930	193.1776	178.0778	175.7305	183.9647	187.1225	200.6148	208.3221	229.0183 (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	15.7025	12.5971	11.3423	8.3098	6.4188	5.2442	5.8554	7.6111	9.8860	12.9710	14.6507	16.1389 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-11.4095	-17.1704	-26.3311	-31.6603	-35.9859	-34.2884	-33.8875	-31.0736	-26.4389	-20.5269	-12.9278	-9.7429 (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	-3.5253	-7.6263	-15.5541	-23.9504	-32.2454	-32.5964	-32.1971	-26.9826	-19.4263	-11.0796	-4.7626	-2.7713 (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	1937.4159 (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	2410.6932 (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)	126.7278 (232)											

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-504.1606 (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	4056.6764 (238)

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

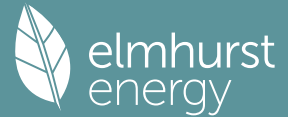
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1937.4159	0.2100	406.8573 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2410.6932	0.2100	506.2456 (264)
Space and water heating			913.1029 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	126.7278	0.1443	18.2907 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-291.4431	0.1332	-38.8270
PV Unit electricity exported	-212.7174	0.1252	-26.6294
Total			-65.4564 (269)
Total CO2, kg/year			877.8665 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.2100 (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	1937.4159	1.1300	2189.2800 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2410.6932	1.1300	2724.0834 (278)
Space and water heating			4913.3633 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	126.7278	1.5338	194.3794 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-291.4431	1.4923	-434.9183
PV Unit electricity exported	-212.7174	0.4595	-97.7413
Total			-532.6596 (283)
Total Primary energy kWh/year			4705.1839 (286)
Target Primary Energy Rate (TPER)			92.2600 (287)

iii. Be Green

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Property Reference	6 Brownlow Road			Issued on Date	07/02/2024
Assessment Reference	Option 2 - Imp Boiler - 1	Prop Type Ref	6 Brownlow Road		
Property	Daisy Court, 6 , Brownlow Road, LONDON, N11 2DE				
SAP Rating	82 B	DER	19.31	TER	15.66
Environmental	85 B	% DER < TER			-23.31
CO ₂ Emissions (t/year)	1.09	DFEE	43.66	TFEE	40.31
Compliance Check	See BREL	% DFEE < TFEE			-8.30
% DPER < TPER	-27.48	DPER	106.70	TPER	83.70
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7000 (1b)	2.5000 (2b)	154.2500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7000		154.2500 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	154.2500 (5)

2. Ventilation rate

		m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1297	(8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000		(17)
Infiltration rate	0.3797		(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) =	0.3797	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.4841	0.4746	0.4651	0.4176	0.4081	0.3607	0.3607	0.3512	0.3797	0.4081	0.4271	0.4461 (22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5650	0.5650	0.5617	0.5721	0.5833	0.5912	0.5995 (25)

3. Heat losses and heat loss parameter

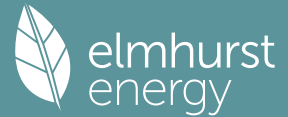
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
PROPOSED (Uw = 1.20)			22.0100	1.1450	25.2023		(27)
EXTERNAL	62.7800	22.0100	40.7700	0.1500	6.1155	18.0000	733.8600 (29a)
HALLWAY	16.8000		16.8000	0.1400	2.3520	18.0000	302.4000 (29a)
FLAT ROOF	61.7000		61.7000	0.1100	6.7870	9.0000	555.3000 (30)
Total net area of external elements Aum(A, m ²)			141.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.4568		(33)
PARTY WALL			11.2800	0.0000	0.0000	180.0000	2030.4000 (32)
PARTY FLOOR			61.7000			40.0000	2468.0000 (32d)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 6089.9600 (34)
98.7028 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.5800	0.3000	3.4740
E3 Sill	5.9500	0.0400	0.2380
E4 Jamb	25.4000	0.0500	1.2700
E7 Party floor between dwellings (in blocks of flats)	25.1100	0.0700	1.7577
E14 Flat roof	25.1100	0.0400	1.0044
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250

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E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.1200	0.3000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.2200	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.1691 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	49.6259 (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	31.4150	31.1834	30.9564	29.8902	29.6908	28.7621	28.7621	28.5902	29.1198	29.6908	30.0943	30.5162 (38)
Heat transfer coeff	81.0409	80.8093	80.5823	79.5161	79.3166	78.3880	78.3880	78.2161	78.7457	79.3166	79.7202	80.1421 (39)
Average = Sum(39)m / 12 =												79.5152
HLP	1.3135	1.3097	1.3060	1.2888	1.2855	1.2705	1.2705	1.2677	1.2763	1.2855	1.2921	1.2989 (40)
HLP (average)												1.2887
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0293 (42)
Hot water usage for mixer showers												58.0206 (42a)
Hot water usage for baths												26.4051 (42b)
Hot water usage for other uses												37.2755 (42c)
Average daily hot water use (litres/day)												112.1504 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	122.0140	119.3897	116.2047	111.3871	107.4657	103.2536	101.6538	104.8253	108.1675	112.5870	117.4780	121.7012 (44)
Energy content (annual)	193.2403	170.0094	178.6023	152.4834	144.6695	126.9623	122.9415	129.7956	133.3813	152.7795	167.3690	190.5547 (45)
Distribution loss (46)m = 0.15 x (45)m												1862.7888
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	244.1992	216.0368	229.5612	201.7985	195.6284	176.2774	173.9004	180.7545	182.6964	203.7384	216.6840	241.5136 (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	244.1992	216.0368	229.5612	201.7985	195.6284	176.2774	173.9004	180.7545	182.6964	203.7384	216.6840	241.5136 (64)
12Total per year (kWh/year)												2462.7888 (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	76.9921	68.0350	72.1250	63.0295	60.8423	54.5437	53.6178	55.8968	56.6780	63.5389	67.9790	76.0992 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	89.3837	98.9605	89.3837	92.3631	89.3837	92.3631	89.3837	89.3837	92.3631	89.3837	92.3631	89.3837 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	177.2131	179.0520	174.4180	164.5527	152.0996	140.3954	132.5763	130.7374	135.3714	145.2367	157.6898	169.3940 (68)
Pumps, fans	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708 (71)
Total internal gains	103.4840	101.2425	96.9422	87.5410	81.7773	75.7552	72.0669	75.1301	78.7195	85.4018	94.4152	102.2838 (72)
	426.5199	435.6941	417.1829	400.8959	379.6997	361.9528	347.4659	348.6902	359.8931	376.4612	400.9072	417.5005 (73)

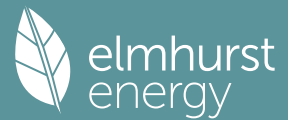
6. Solar gains

[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				5.8100	10.6334		0.6300		0.7000		0.7700		18.8808 (74)
East				7.7300	19.6403		0.6300		0.7000		0.7700		46.3979 (76)
West				8.4700	19.6403		0.6300		0.7000		0.7700		50.8396 (80)
Solar gains	116.1184	226.2995	374.5732	555.3556	692.5802	715.1948	678.2795	573.9320	438.0527	268.6600	144.5357	95.7034	83)
Total gains	542.6382	661.9935	791.7561	956.2515	1072.2799	1077.1475	1025.7454	922.6222	797.9458	645.1211	545.4429	513.2039	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

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tau	20.8741	20.9339	20.9929	21.2744	21.3279	21.5805	21.5805	21.6280	21.4825	21.3279	21.2199	21.1082
alpha	2.3916	2.3956	2.3995	2.4183	2.4219	2.4387	2.4387	2.4419	2.4322	2.4219	2.4147	2.4072
util living area	0.9295	0.8917	0.8273	0.7096	0.5677	0.4241	0.3202	0.3651	0.5645	0.7887	0.8994	0.9369 (86)
MIT	18.3246	18.7577	19.3781	20.0991	20.5901	20.8567	20.9475	20.9267	20.7035	19.9948	19.0401	18.2593 (87)
Th 2	19.8303	19.8332	19.8361	19.8497	19.8522	19.8640	19.8640	19.8662	19.8595	19.8522	19.8471	19.8417 (88)
util rest of house	0.9193	0.8768	0.8042	0.6736	0.5176	0.3594	0.2431	0.2833	0.4959	0.7518	0.8829	0.9277 (89)
MIT 2	16.7582	17.2977	18.0611	18.9262	19.4782	19.7596	19.8372	19.8261	19.6226	18.8367	17.6699	16.6829 (90)
Living area fraction	17.4361	17.9295	18.6310	19.4337	19.9594	20.2344	20.3176	20.3024	20.0903	19.3378	18.2628	17.3651 (92)
MIT	17.4361	17.9295	18.6310	19.4337	19.9594	20.2344	20.3176	20.3024	20.0903	19.3378	18.2628	17.3651 (93)
Temperature adjustment												0.0000
adjusted MIT	17.4361	17.9295	18.6310	19.4337	19.9594	20.2344	20.3176	20.3024	20.0903	19.3378	18.2628	17.3651 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8911	0.8460	0.7760	0.6593	0.5225	0.3812	0.2745	0.3156	0.5106	0.7327	0.8538	0.9009 (94)
Useful gains	483.5354	560.0419	614.3816	630.4568	560.2598	410.5899	281.5929	291.2061	407.4317	472.6591	465.7118	462.3382 (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	1064.5590	1052.9036	977.5453	837.6011	655.1064	441.6670	291.4179	305.2294	471.7140	693.0536	889.9026	1055.0771 (97)
Space heating kWh	432.2816	331.2031	270.1938	149.1439	70.5659	0.0000	0.0000	0.0000	0.0000	163.9735	305.4173	440.9977 (98a)
Space heating requirement - total per year (kWh/year)												2163.7768
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	432.2816	331.2031	270.1938	149.1439	70.5659	0.0000	0.0000	0.0000	0.0000	163.9735	305.4173	440.9977 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2163.7768
Space heating per m2										(98c) / (4) =		35.0693 (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	432.2816	331.2031	270.1938	149.1439	70.5659	0.0000	0.0000	0.0000	0.0000	163.9735	305.4173	440.9977 (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)	514.0090	393.8206	321.2768	177.3411	83.9071	0.0000	0.0000	0.0000	0.0000	194.9744	363.1597	524.3730 (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	244.1992	216.0368	229.5612	201.7985	195.6284	176.2774	173.9004	180.7545	182.6964	203.7384	216.6840	241.5136 (64)
Efficiency of water heater (217)m	85.7915	85.4943	84.9321	83.9433	82.6138	80.5000	80.5000	80.5000	80.5000	84.1207	85.3172	80.5000 (216)
Fuel for water heating, kWh/month	284.6428	252.6914	270.2878	240.3985	236.7986	218.9781	216.0253	224.5398	226.9520	242.1978	253.9746	281.3061 (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	17.2815	13.8639	12.4829	9.1455	7.0642	5.7715	6.4442	8.3765	10.8802	14.2754	16.1240	17.7618 (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												2572.8619 (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												2948.7929 (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)												139.4716 (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)

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Total delivered energy for all uses

5747.1264 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	2572.8619	0.2100	540.3010	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)	2948.7929	0.2100	619.2465	(264)
Space and water heating			1159.5475	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.4716	0.1443	20.1301	(268)
Total CO ₂ , kg/year			1191.6068	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			19.3100	(273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year	
Space heating - main system 1	2572.8619	1.1300	2907.3339	(275)
Total CO ₂ associated with community systems			0.0000	(473)
Water heating (other fuel)	2948.7929	1.1300	3332.1360	(278)
Space and water heating			6239.4699	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.4716	1.5338	213.9262	(282)
Total Primary energy kWh/year			6583.4969	(286)
Dwelling Primary energy Rate (DPER)			106.7000	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	61.7000	(1b)	x 2.5000	(2b) = 154.2500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	154.2500 (5)

2. Ventilation rate

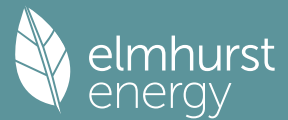
		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
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)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1297 (8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000		(17)
Infiltration rate	0.3797		(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) =		0.3797 (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	0.4841	0.4746	0.4651	0.4176	0.4081	0.3607	0.3607	0.3512	0.3797	0.4081	0.4271	0.4461	(22b)
Effective ac	0.6172	0.6126	0.6082	0.5872	0.5833	0.5650	0.5650	0.5617	0.5721	0.5833	0.5912	0.5995	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opening Type (U _w = 1.20)			15.4300	1.1450	17.6679			(27)
EXTERNAL	62.7800	15.4300	47.3500	0.1800	8.5230			(29a)
HALLWAY	16.8000		16.8000	0.1800	3.0240			(29a)
FLAT ROOF	61.7000		61.7000	0.1100	6.7870			(30)
Total net area of external elements A _{um} (A, m ²)			141.2800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0019			(33)
PARTY WALL			11.2800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							98.7028	(35)
List of Thermal Bridges								

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K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.5800	0.0500	0.5790
E3 Sill	5.9500	0.0500	0.2975
E4 Jamb	25.4000	0.0500	1.2700
E7 Party floor between dwellings (in blocks of flats)	25.1100	0.0700	1.7577
E14 Flat roof	25.1100	0.0800	2.0088
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.0600	0.1500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	10.2200	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.1880 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	43.1899 (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	31.4150	31.1834	30.9564	29.8902	29.6908	28.7621	28.7621	28.5902	29.1198	29.6908	30.0943	30.5162	(38)
Heat transfer coeff	74.6049	74.3733	74.1464	73.0802	72.8807	71.9521	71.9521	71.7801	72.3098	72.8807	73.2842	73.7061	(39)
Average = Sum(39)m / 12 =												73.0792	
HLP	1.2092	1.2054	1.2017	1.1844	1.1812	1.1662	1.1662	1.1634	1.1720	1.1812	1.1878	1.1946	(40)
HLP (average)												1.1844	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.0293 (42)
Hot water usage for mixer showers	58.2438	57.3685	56.0930	53.6526	51.8517	49.8433	48.7017	49.9675	51.3551	53.5115	56.0043	58.0206	(42a)
Hot water usage for baths	25.1700	24.7961	24.2697	23.2992	22.5724	21.7665	21.3312	21.8539	22.4231	23.2854	24.2760	25.0849	(42b)
Hot water usage for other uses	35.4117	34.1240	32.8363	31.5486	30.2609	28.9732	28.9732	30.2609	31.5486	32.8363	34.1240	35.4117	(42c)
Average daily hot water use (litres/day)												109.2278	(43)
Daily hot water use	118.8255	116.2887	113.1991	108.5004	104.6850	100.5831	99.0062	102.0824	105.3268	109.6333	114.4043	118.5172	(44)
Energy conte	188.1905	165.5935	173.9828	148.5316	140.9261	123.6786	119.7394	126.3994	129.8785	148.7713	162.9899	185.5693	(45)
Energy content (annual)										Total = Sum(45)m =		1814.2510	
Distribution loss (46)m = 0.15 x (45)m	28.2286	24.8390	26.0974	22.2797	21.1389	18.5518	17.9609	18.9599	19.4818	22.3157	24.4485	27.8354	(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													
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	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.4525	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	239.1494	211.6209	224.9417	197.8467	191.8851	172.9937	170.1919	177.3583	179.1936	199.7302	212.3050	236.5282	(62)
WWHRS	-26.6266	-23.5488	-24.6589	-20.4186	-19.0294	-16.2836	-15.2633	-16.2309	-16.8476	-19.8615	-22.5006	-26.1335	(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	212.5228	188.0721	200.2827	177.4281	172.8557	156.7101	154.9286	161.1273	162.3460	179.8687	189.8044	210.3947	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2166.3412	(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	75.3131	66.5667	70.5890	61.7155	59.5977	53.4519	52.4265	54.7675	55.5134	62.2062	66.5229	74.4415	(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	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	101.4635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.3837	98.9605	89.3837	92.3631	89.3837	92.3631	89.3837	89.3837	92.3631	89.3837	92.3631	89.3837	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.2131	179.0520	174.4180	164.5527	152.0996	140.3954	132.5763	130.7374	135.3714	145.2367	157.6898	169.3940	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	33.1463	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	-81.1708	(71)
Water heating gains (Table 5)	101.2272	99.0576	94.8777	85.7160	80.1044	74.2388	70.4657	73.6123	77.1019	83.6105	92.3929	100.0558	(72)
Total internal gains	424.2630	433.5091	415.1184	399.0709	378.0267	360.4364	345.8647	347.1724	358.2755	374.6699	398.8849	415.2725	(73)

6. Solar gains

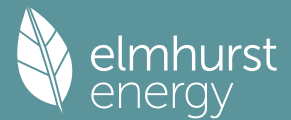
[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.0700	10.6334	0.6300	0.7000	0.7700	13.2263 (74)			
East				5.4200	19.6403	0.6300	0.7000	0.7700	32.5326 (76)			
West				5.9400	19.6403	0.6300	0.7000	0.7700	35.6538 (80)			
Solar gains	81.4126	158.6631	262.6197	389.3638	485.5659	501.4173	475.5378	402.3854	307.1247	188.3628	101.3367	67.0992 (83)
Total gains	505.6757	592.1722	677.7381	788.4348	863.5926	861.8536	821.4025	749.5578	665.4002	563.0327	500.2216	482.3717 (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	22.6749	22.7455	22.8151	23.1479	23.2113	23.5109	23.5109	23.5672	23.3946	23.2113	23.0835	22.9514
alpha	2.5117	2.5164	2.5210	2.5432	2.5474	2.5674	2.5674	2.5711	2.5596	2.5474	2.5389	2.5301
util living area	0.9356	0.9062	0.8562	0.7576	0.6269	0.4786	0.3642	0.4089	0.6098	0.8149	0.9090	0.9417 (86)
MIT	18.4779	18.8406	19.3809	20.0555	20.5504	20.8409	20.9423	20.9214	20.6920	20.0144	19.1459	18.4285 (87)
Th 2	19.9127	19.9157	19.9186	19.9325	19.9351	19.9472	19.9472	19.9494	19.9425	19.9351	19.9298	19.9243 (88)
util rest of house	0.9265	0.8934	0.8366	0.7257	0.5793	0.4134	0.2842	0.3256	0.5445	0.7823	0.8944	0.9334 (89)
MIT 2	16.9968	17.4511	18.1219	18.9439	19.5125	19.8262	19.9158	19.9038	19.6873	18.9207	17.8507	16.9415 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.6377	18.0524	18.6667	19.4250	19.9616	20.2653	20.3600	20.3442	20.1221	19.3940	18.4112	17.5850 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6377	18.0524	18.6667	19.4250	19.9616	20.2653	20.3600	20.3442	20.1221	19.3940	18.4112	17.5850 (93)
8. Space heating requirement												
Utilisation	0.9010	0.8653	0.8094	0.7088	0.5805	0.4338	0.3164	0.3579	0.5563	0.7629	0.8679	0.9091 (94)
Useful gains	455.6016	512.4312	548.5792	558.8694	501.3303	373.8696	259.8559	268.2392	370.1942	429.5437	434.1388	438.5327 (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	995.0575	978.1890	902.1156	769.1664	602.1139	407.6299	270.5402	283.1117	435.4557	640.9106	828.9327	986.5533 (97)
Space heating kWh	401.3551	312.9892	263.0310	151.4139	74.9830	0.0000	0.0000	0.0000	0.0000	157.2570	284.2516	407.7273 (98a)
Space heating requirement - total per year (kWh/year)												2053.0083
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	401.3551	312.9892	263.0310	151.4139	74.9830	0.0000	0.0000	0.0000	0.0000	157.2570	284.2516	407.7273 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2053.0083
Space heating per m2												(98c) / (4) = 33.2740 (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	401.3551	312.9892	263.0310	151.4139	74.9830	0.0000	0.0000	0.0000	0.0000	157.2570	284.2516	407.7273 (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)	434.3670	338.7329	284.6656	163.8679	81.1504	0.0000	0.0000	0.0000	0.0000	170.1916	307.6316	441.2633 (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	212.5228	188.0721	200.2827	177.4281	172.8557	156.7101	154.9286	161.1273	162.3460	179.8687	189.8044	210.3947 (64)
Efficiency of water heater (217)m	85.7217	85.4644	84.9663	84.0435	82.7211	80.3000	80.3000	80.3000	80.3000	84.0948	85.2447	80.3000 (216)
Fuel for water heating, kWh/month	247.9218	220.0590	235.7201	211.1146	208.9621	195.1558	192.9373	200.6567	202.1743	213.8881	222.6583	245.2918 (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	18.5722	14.8993	13.4151	9.8285	7.5918	6.2026	6.9255	9.0020	11.6928	15.3415	17.3282	19.0883 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.7324	-20.6272	-31.5699	-37.8756	-42.9663	-40.8971	-40.4073	-37.0864	-31.6135	-24.6139	-15.5428	-11.7299 (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	-4.3358	-9.3719	-19.1030	-29.4024	-39.5802	-40.0204	-39.5422	-33.1501	-23.8744	-13.6237	-5.8592	-3.4098 (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												2221.8704 (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												2596.5400 (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)												149.8880 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-609.9354 (233)

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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	4444.3629 (238)

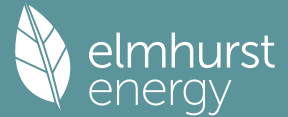
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2221.8704	0.2100	466.5928 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2596.5400	0.2100	545.2734 (264)
Space and water heating			1011.8662 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	149.8880	0.1443	21.6335 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-348.6623	0.1333	-46.4665
PV Unit electricity exported	-261.2731	0.1252	-32.7091
Total			-79.1756 (269)
Total CO2, kg/year			966.2533 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			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	2221.8704	1.1300	2510.7136 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2596.5400	1.1300	2934.0902 (278)
Space and water heating			5444.8037 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	149.8880	1.5338	229.9032 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-348.6623	1.4925	-520.3684
PV Unit electricity exported	-261.2731	0.4595	-120.0561
Total			-640.4246 (283)
Total Primary energy kWh/year			5164.3832 (286)
Target Primary Energy Rate (TPER)			83.7000 (287)

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Property Reference	6 Brownlow Road			Issued on Date	07/02/2024
Assessment Reference	Option 2 - Imp Boiler - 2	Prop Type Ref	6 Brownlow Road		
Property	Daisy Court, 6 , Brownlow Road, LONDON, N11 2DE				
SAP Rating	82 B	DER	21.04	TER	17.21
Environmental	85 B	% DER < TER			-22.25
CO ₂ Emissions (t/year)	0.98	DFEE	46.26	TFEE	42.47
Compliance Check	See BREL	% DFEE < TFEE			-8.90
% DPER < TPER	-25.99	DPER	116.24	TPER	92.26
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.0000 (1b)	2.5000 (2b)	127.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	127.5000 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1569 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4069 (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) = 0.4069 (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	0.5187	0.5086	0.4984	0.4475	0.4374	0.3865	0.3865	0.3763	0.4069	0.4374	0.4577	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5956	0.5747	0.5747	0.5708	0.5828	0.5956	0.6048	0.6143 (25)

3. Heat losses and heat loss parameter

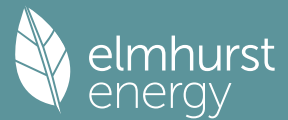
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
PROPOSED (Uw = 1.20)			20.0400	1.1450	22.9466		(27)
EXTERNAL	64.1000	20.0400	44.0600	0.1500	6.6090	18.0000	793.0800 (29a)
HALLWAY	14.2800		14.2800	0.1400	1.9992	18.0000	257.0400 (29a)
FLAT ROOF	51.0000		51.0000	0.1100	5.6100	9.0000	459.0000 (30)
Total net area of external elements Aum(A, m ²)			129.3800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.1648		(33)
PARTY WALL			11.2800	0.0000	0.0000	180.0000	2030.4000 (32)
PARTY FLOOR			51.0000			40.0000	2040.0000 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5579.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 109.4024 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.4500	0.3000	3.1350
E3 Sill	4.2000	0.0400	0.1680
E4 Jamb	23.6000	0.0500	1.1800
E7 Party floor between dwellings (in blocks of flats)	25.6400	0.0700	1.7948
E14 Flat roof	25.6400	0.0400	1.0256
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250

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E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.1200	0.3000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.2300	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.7284 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	45.8932 (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	26.6987	26.4789	26.2634	25.2513	25.0620	24.1804	24.1804	24.0172	24.5200	25.0620	25.4450	25.8455 (38)
Heat transfer coeff												
	72.5919	72.3721	72.1566	71.1445	70.9551	70.0736	70.0736	69.9104	70.4132	70.9551	71.3382	71.7387 (39)
Average = Sum(39)m / 12 =												71.1436
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4234	1.4191	1.4148	1.3950	1.3913	1.3740	1.3740	1.3708	1.3807	1.3913	1.3988	1.4066 (40)
HLP (average)												1.3950
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

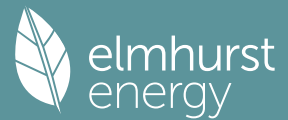
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.7196 (42)
Hot water usage for mixer showers												
53.0510	52.2538	51.0920	48.8692	47.2288	45.3995	44.3597	45.5127	46.7765	48.7407	51.0112	52.8478	(42a)
Hot water usage for baths												
24.1441	23.7855	23.2806	22.3496	21.6524	20.8794	20.4618	20.9633	21.5092	22.3364	23.2866	24.0625	(42b)
Hot water usage for other uses												
33.9370	32.7029	31.4688	30.2348	29.0007	27.7666	27.7666	29.0007	30.2348	31.4688	32.7029	33.9370	(42c)
Average daily hot water use (litres/day)												102.1485 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.1321	108.7422	105.8415	101.4536	97.8820	94.0455	92.5882	95.4766	98.5205	102.5459	107.0007	110.8473 (44)
Energy conte	176.0061	154.8475	162.6744	138.8848	131.7679	115.6399	111.9774	118.2200	121.4857	139.1538	152.4422	173.5600 (45)
Energy content (annual)										Total = Sum(45)m =		1696.6598
Distribution loss (46)m = 0.15 x (45)m												
26.4009	23.2271	24.4012	20.8327	19.7652	17.3460	16.7966	17.7330	18.2228	20.8731	22.8663	26.0340	(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	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.8796	46.3786	47.1819	48.6538	48.5855	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
226.9651	200.8749	213.6333	188.1999	181.6475	162.0186	159.1593	166.8739	170.0711	190.1127	201.7572	224.5189	(62)
WWHRS	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	(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	(63c)
FGHRS	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	226.9651	200.8749	213.6333	188.1999	181.6475	162.0186	159.1593	166.8739	170.0711	190.1127	201.7572	224.5189 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2285.8324 (64)
Electric shower(s)												2286 (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												
71.2618	62.9936	66.8290	58.5080	56.2827	50.0449	49.0280	51.4716	52.5403	59.0084	63.0158	70.4484	(65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
75.5724	83.6695	75.5724	78.0915	75.5724	78.0915	75.5724	75.5724	78.0915	75.5724	78.0915	75.5724	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
149.8308	151.3856	147.4676	139.1267	128.5978	118.7021	112.0911	110.5364	114.4543	122.7953	133.3242	143.2199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	(71)
Water heating gains (Table 5)												
95.7819	93.7405	89.8239	81.2611	75.6488	69.5069	65.8978	69.1823	72.9727	79.3123	87.5219	94.6888	(72)
Total internal gains	372.9787	380.5892	364.6575	350.2728	331.6126	315.0940	302.3549	304.0846	314.3121	329.4736	350.7312	365.2746 (73)

6. Solar gains												
[Jan]			Area	Solar flux	g	FF			Access		Gains	
			m2	Table 6a	Specific data	Specific data			factor		W	
				W/m2	or Table 6b	or Table 6c			Table 6d			
North			2.0000	10.6334	0.6300	0.7000			0.7700		6.4994 (74)	
East			6.8400	19.6403	0.6300	0.7000			0.7700		41.0559 (76)	
South			2.7300	46.7521	0.6300	0.7000			0.7700		39.0063 (78)	
West			8.4700	19.6403	0.6300	0.7000			0.7700		50.8396 (80)	
Solar gains	137.4013	256.0702	398.5314	557.6450	670.6613	682.8045	651.4652	566.7110	454.7010	296.9972	168.8366	114.6937 (83)
Total gains	510.3800	636.6593	763.1889	907.9178	1002.2738	997.8985	953.8201	870.7956	769.0131	626.4707	519.5678	479.9683 (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)												

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.3504	21.4153	21.4792	21.7848	21.8429	22.1177	22.1177	22.1693	22.0110	21.8429	21.7256	21.6043
alpha	2.4234	2.4277	2.4319	2.4523	2.4562	2.4745	2.4745	2.4780	2.4674	2.4562	2.4484	2.4403
util living area	0.9250	0.8804	0.8100	0.6912	0.5529	0.4130	0.3096	0.3489	0.5377	0.7662	0.8904	0.9336 (86)
MIT	18.4292	18.8971	19.5095	20.1828	20.6294	20.8717	20.9541	20.9374	20.7455	20.0955	19.1491	18.3571 (87)
Th 2	19.7455	19.7488	19.7520	19.7672	19.7700	19.7833	19.7833	19.7858	19.7782	19.7700	19.7643	19.7582 (88)
util rest of house	0.9132	0.8628	0.7835	0.6514	0.4989	0.3444	0.2289	0.2639	0.4645	0.7240	0.8712	0.9231 (89)
MIT 2	16.8259	17.4047	18.1511	18.9502	19.4436	19.6950	19.7620	19.7545	19.5857	18.8831	17.7403	16.7434 (90)
Living area fraction	17.6150	18.1392	18.8197	19.5568	20.0272	20.2741	20.3487	20.3367	20.1565	19.4798	18.4337	17.5376 (92)
MIT	17.6150	18.1392	18.8197	19.5568	20.0272	20.2741	20.3487	20.3367	20.1565	19.4798	18.4337	17.5376 (93)
Temperature adjustment												0.0000
adjusted MIT	17.6150	18.1392	18.8197	19.5568	20.0272	20.2741	20.3487	20.3367	20.1565	19.4798	18.4337	17.5376 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8869	0.8350	0.7605	0.6440	0.5108	0.3728	0.2671	0.3034	0.4883	0.7127	0.8453	0.8979 (94)
Useful gains	452.6398	531.5895	580.3726	584.6811	511.9160	372.0235	254.7654	264.1718	375.5154	446.4830	439.1851	430.9817 (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	966.5591	958.1468	888.9456	758.1732	590.8570	397.6070	262.6845	275.2149	426.4593	630.0673	808.5235	956.8247 (97)
Space heating kWh	382.3559	286.6465	229.5783	124.9143	58.7321	0.0000	0.0000	0.0000	0.0000	136.5867	265.9236	391.2272 (98a)
Space heating requirement - total per year (kWh/year)												1875.9647
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	382.3559	286.6465	229.5783	124.9143	58.7321	0.0000	0.0000	0.0000	0.0000	136.5867	265.9236	391.2272 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1875.9647
Space heating per m2										(98c) / (4) =		36.7836 (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	382.3559	286.6465	229.5783	124.9143	58.7321	0.0000	0.0000	0.0000	0.0000	136.5867	265.9236	391.2272 (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)	454.6443	340.8401	272.9826	148.5307	69.8360	0.0000	0.0000	0.0000	0.0000	162.4099	316.1993	465.1928 (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	226.9651	200.8749	213.6333	188.1999	181.6475	162.0186	159.1593	166.8739	170.0711	190.1127	201.7572	224.5189 (64)
Efficiency of water heater (217)m	85.6901	85.3433	84.7365	83.7239	82.4443	80.5000	80.5000	80.5000	80.5000	83.8851	85.1745	80.5000 (216)
Fuel for water heating, kWh/month	264.8674	235.3727	252.1147	224.7864	220.3276	201.2653	197.7134	207.2967	211.2685	226.6348	236.8751	261.8012 (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	14.6112	11.7217	10.5541	7.7324	5.9727	4.8797	5.4485	7.0822	9.1990	12.0696	13.6326	15.0173 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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)	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												2230.6358 (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												2740.3239 (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)												117.9210 (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)

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Energy used 0.0000 (237)
Total delivered energy for all uses 5174.8806 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	2230.6358	0.2100	468.4335 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	2740.3239	0.2100	575.4680 (264)
Space and water heating			1043.9015 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	117.9210	0.1443	17.0196 (268)
Total CO ₂ , kg/year			1072.8504 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			21.0400 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	2230.6358	1.1300	2520.6184 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	2740.3239	1.1300	3096.5660 (278)
Space and water heating			5617.1844 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	117.9210	1.5338	180.8711 (282)
Total Primary energy kWh/year			5928.1563 (286)
Dwelling Primary energy Rate (DPER)			116.2400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.0000 (1b)	x 2.5000 (2b)	= 127.5000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	127.5000 (5)

2. Ventilation rate

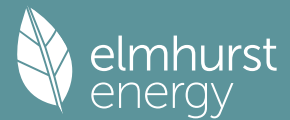
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1569 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4069 (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) = 0.4069 (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	0.5187	0.5086	0.4984	0.4475	0.4374	0.3865	0.3865	0.3763	0.4069	0.4374	0.4577	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5956	0.5747	0.5747	0.5708	0.5828	0.5956	0.6048	0.6143 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (U _w = 1.20)			12.7500	1.1450	14.5992		(27)
EXTERNAL	64.1000		51.3500	0.1800	9.2430		(29a)
HALLWAY	14.2800		14.2800	0.1800	2.5704		(29a)
FLAT ROOF	51.0000		51.0000	0.1100	5.6100		(30)
Total net area of external elements A _{um} (A, m ²)			129.3800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0226		(33)
PARTY WALL			11.2800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							109.4024 (35)

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List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.4500	0.0500	0.5225
E3 Sill	4.2000	0.0500	0.2100
E4 Jamb	23.6000	0.0500	1.1800
E7 Party floor between dwellings (in blocks of flats)	25.6400	0.0700	1.7948
E14 Flat roof	25.6400	0.0800	2.0512
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
E25 Staggered party wall between dwellings	2.5000	0.0600	0.1500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.2300	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.0335 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	39.0561 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	26.6987	26.4789	26.2634	25.2513	25.0620	24.1804	24.1804	24.0172	24.5200	25.0620	25.4450	25.8455 (38)
Average = Sum(39)m / 12 =	65.7549	65.5350	65.3195	64.3075	64.1181	63.2366	63.2366	63.0733	63.5761	64.1181	64.5012	64.9017 (39)
												64.3065
HLP	1.2893	1.2850	1.2808	1.2609	1.2572	1.2399	1.2399	1.2367	1.2466	1.2572	1.2647	1.2726 (40)
HLP (average)												1.2609
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7196 (42)
Hot water usage for mixer showers												
53.0510	52.2538	51.0920	48.8692	47.2288	45.3995	44.3597	45.5127	46.7765	48.7407	51.0112	52.8478 (42a)	
Hot water usage for baths												
22.9369	22.5963	22.1166	21.2321	20.5698	19.8354	19.4388	19.9151	20.4338	21.2196	22.1223	22.8594 (42b)	
Hot water usage for other uses												
32.2401	31.0678	29.8954	28.7230	27.5507	26.3783	26.3783	27.5507	28.7230	29.8954	31.0678	32.2401 (42c)	
Average daily hot water use (litres/day)												99.4866 (43)
Daily hot water use												
108.2281	105.9178	103.1040	98.8243	95.3493	91.6132	90.1768	92.9784	95.9333	99.8556	104.2013	107.9473 (44)	
Energy content (annual)	171.4068	150.8256	158.4670	135.2856	128.3585	112.6492	109.0610	115.1267	118.2954	135.5032	148.4538	169.0194 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1652.4520
25.7110	22.6238	23.7701	20.2928	19.2538	16.8974	16.3591	17.2690	17.7443	20.3255	22.2681	25.3529 (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 (59)	
Combi loss	50.9589	46.0274	50.9589	48.7353	48.5890	45.1791	45.9531	47.3808	47.3096	50.8853	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
222.3657	196.8530	209.4259	184.0209	176.9474	157.8283	155.0141	162.5075	165.6050	186.3885	197.7689	219.9783 (62)	
WWHRS	-24.2527	-21.4493	-22.4605	-18.5982	-17.3328	-14.8318	-13.9025	-14.7839	-15.3456	-18.0907	-20.4946	-23.8036 (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												
198.1130	175.4037	186.9654	165.4227	159.6146	142.9965	141.1116	147.7236	150.2594	168.2978	177.2743	196.1747 (64)	
12Total per year (kWh/year)												2009.3572 (64)
Electric shower(s)												2009 (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												
69.7325	61.6563	65.4300	57.1663	54.8264	48.7506	47.7510	50.1248	51.1606	57.7761	61.6897	68.9387 (65)	

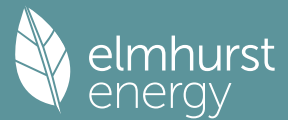
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785	85.9785 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	75.5724	83.6695	75.5724	78.0915	75.5724	78.0915	75.5724	75.5724	78.0915	75.5724	78.0915	75.5724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	149.8308	151.3856	147.4676	139.1267	128.5978	118.7021	112.0911	110.5364	114.4543	122.7953	133.3242	143.2199 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979	31.5979 (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)												
	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828	-68.7828 (71)
Water heating gains (Table 5)												
	93.7265	91.7505	87.9436	79.3976	73.6914	67.7092	64.1815	67.3721	71.0564	77.6561	85.6801	92.6595 (72)
Total internal gains												
	370.9233	378.5991	362.7771	348.4094	329.6552	313.2963	300.6386	302.2744	312.3958	327.8173	348.8893	363.2454 (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				1.2700	10.6334		0.6300		0.7000		0.7700		4.1271 (74)
East				4.3500	19.6403		0.6300		0.7000		0.7700		26.1101 (76)
South				1.7400	46.7521		0.6300		0.7000		0.7700		24.8612 (78)
West				5.3900	19.6403		0.6300		0.7000		0.7700		32.3525 (80)
Solar gains	87.4509	162.9686	253.6107	354.8337	426.7236	434.4409	414.5047	360.5934	289.3441	189.0089	107.4563		72.9997 (83)

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Total gains 458.3742 541.5677 616.3878 703.2431 756.3788 747.7372 715.1433 662.8678 601.7399 516.8262 456.3456 436.2451 (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	23.5704	23.6494	23.7275	24.1009	24.1721	24.5090	24.5090	24.5725	24.3781	24.1721	24.0285	23.8802
alpha	2.5714	2.5766	2.5818	2.6067	2.6115	2.6339	2.6339	2.6382	2.6252	2.6115	2.6019	2.5920
util living area	0.9355	0.9039	0.8533	0.7582	0.6328	0.4860	0.3686	0.4084	0.6027	0.8078	0.9071	0.9420 (86)
MIT	18.5778	18.9502	19.4717	20.1057	20.5698	20.8482	20.9463	20.9286	20.7211	20.0884	19.2398	18.5282 (87)
Th 2	19.8492	19.8526	19.8559	19.8716	19.8745	19.8882	19.8882	19.8907	19.8829	19.8745	19.8686	19.8624 (88)
util rest of house	0.9257	0.8897	0.8319	0.7239	0.5817	0.4159	0.2827	0.3198	0.5327	0.7717	0.8911	0.9331 (89)
MIT 2	17.0715	17.5364	18.1812	18.9510	19.4799	19.7775	19.8610	19.8521	19.6610	18.9559	17.9172	17.0171 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.8128	18.2322	18.8163	19.5193	20.0163	20.3045	20.3951	20.3819	20.1828	19.5133	18.5681	17.7608 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.8128	18.2322	18.8163	19.5193	20.0163	20.3045	20.3951	20.3819	20.1828	19.5133	18.5681	17.7608 (93)

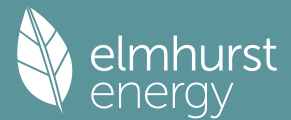
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9026	0.8647	0.8088	0.7121	0.5886	0.4430	0.3228	0.3602	0.5526	0.7584	0.8678	0.9111 (94)
Useful gains	413.7131	468.2894	498.5282	500.7457	445.1777	331.2735	230.8302	238.7341	332.5155	391.9632	396.0024	397.4513 (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	888.5340	873.7278	804.4979	682.9017	533.2247	360.7312	239.9907	251.1522	386.7188	571.5019	739.7082	880.1194 (97)
Space heating kWh	353.2667	272.4546	227.6414	131.1523	65.5070	0.0000	0.0000	0.0000	0.0000	133.5768	247.4682	359.1051 (98a)
Space heating requirement - total per year (kWh/year)	1790.1723											
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	353.2667	272.4546	227.6414	131.1523	65.5070	0.0000	0.0000	0.0000	0.0000	133.5768	247.4682	359.1051 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1790.1723											
Space heating per m2	(98c) / (4) = 35.1014 (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	353.2667	272.4546	227.6414	131.1523	65.5070	0.0000	0.0000	0.0000	0.0000	133.5768	247.4682	359.1051 (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)	382.3233	294.8643	246.3652	141.9398	70.8950	0.0000	0.0000	0.0000	0.0000	144.5636	267.8227	388.6419 (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	198.1130	175.4037	186.9654	165.4227	159.6146	142.9965	141.1116	147.7236	150.2594	168.2978	177.2743	196.1747 (64)
Efficiency of water heater (217)m	85.6058	85.3212	84.8043	83.8887	82.6259	80.3000	80.3000	80.3000	80.3000	83.8910	85.0962	80.3000 (216)
Fuel for water heating, kWh/month	231.4247	205.5804	220.4669	197.1930	193.1776	178.0778	175.7305	183.9647	187.1225	200.6148	208.3221	229.0183 (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	15.7025	12.5971	11.3423	8.3098	6.4188	5.2442	5.8554	7.6111	9.8860	12.9710	14.6507	16.1389 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-11.4095	-17.1704	-26.3311	-31.6603	-35.9859	-34.2884	-33.8875	-31.0736	-26.4389	-20.5269	-12.9278	-9.7429 (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	-3.5253	-7.6263	-15.5541	-23.9504	-32.2454	-32.5964	-32.1971	-26.9826	-19.4263	-11.0796	-4.7626	-2.7713 (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	1937.4159 (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	2410.6932 (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)	126.7278 (232)											

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-504.1606 (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	4056.6764 (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	1937.4159	0.2100	406.8573 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2410.6932	0.2100	506.2456 (264)
Space and water heating			913.1029 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	126.7278	0.1443	18.2907 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-291.4431	0.1332	-38.8270
PV Unit electricity exported	-212.7174	0.1252	-26.6294
Total			-65.4564 (269)
Total CO2, kg/year			877.8665 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.2100 (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	1937.4159	1.1300	2189.2800 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2410.6932	1.1300	2724.0834 (278)
Space and water heating			4913.3633 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	126.7278	1.5338	194.3794 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-291.4431	1.4923	-434.9183
PV Unit electricity exported	-212.7174	0.4595	-97.7413
Total			-532.6596 (283)
Total Primary energy kWh/year			4705.1839 (286)
Target Primary Energy Rate (TPER)			92.2600 (287)

B.GHA Overheating Tool

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019



This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply.

Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes.

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING

KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map	South east	4	4
	Northern England, Scotland & NI	0	
	Rest of England and Wales	2	
#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3	2
	Grtr London, Manchester, B'ham	2	
	Other cities, towns & dense sub-urban areas	1	

#8 Do the site surroundings feature significant blue/green infrastructure?

Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context

1 0

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	Day - reasons to keep all windows closed	8	0
	Day - barriers some of the time, or for some windows e.g. on quiet side	4	
	Night - reasons to keep all windows closed	8	0
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green?

Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme

1 0

#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas?

Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels

1 1

Scheme characteristics and dwelling design

#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3	3
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3	0

#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation?

Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance

1 1

#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future?

Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans

>2.8m and fan installed	2	1
> 2.8m	1	

Solar heat gains and ventilation

#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65%	12	7
	>50%	7	
	>35%	4	
#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation	Single-aspect	3	0
	Dual aspect	0	

#13 Is there useful external shading?

Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6

	Full	Part	2
>65%	6	3	
>50%	4	2	
>35%	2	1	

#14 Do windows & openings support effective ventilation?

Larger, effective and secure openings will help dissipate heat - see guidance

	Openings compared to Part F purge rates			3
	= Part F minimum required	+50%	+100%	
Single-aspect	3	4		
Dual aspect	2	3		

TOTAL SCORE

8

= Sum of contributing factors:

16

minus

Sum of mitigating factors:

8

High

12

Medium

8

Low

score >12:

Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score between 8 and 12:

Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score <8:

Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)