



EAL CONSULT BUILDING SUSTAINABILITY SINCE 2008

ENERGY & SUSTAINABILITY ASSESSMENT

SIDE OF 57A SANDFORD AVENUE

PROPERTY ADDRESS

Side of 57A Sandford Road
N22 5EJ

DATE

September 2026

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 one new-build dwelling at the Side of 57A Sandford Avenue.

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 2024, 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 **73%** 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 PV Panels have been proposed for the specific scheme and will deliver a further **15%** 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 **87%**

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
- Very 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.

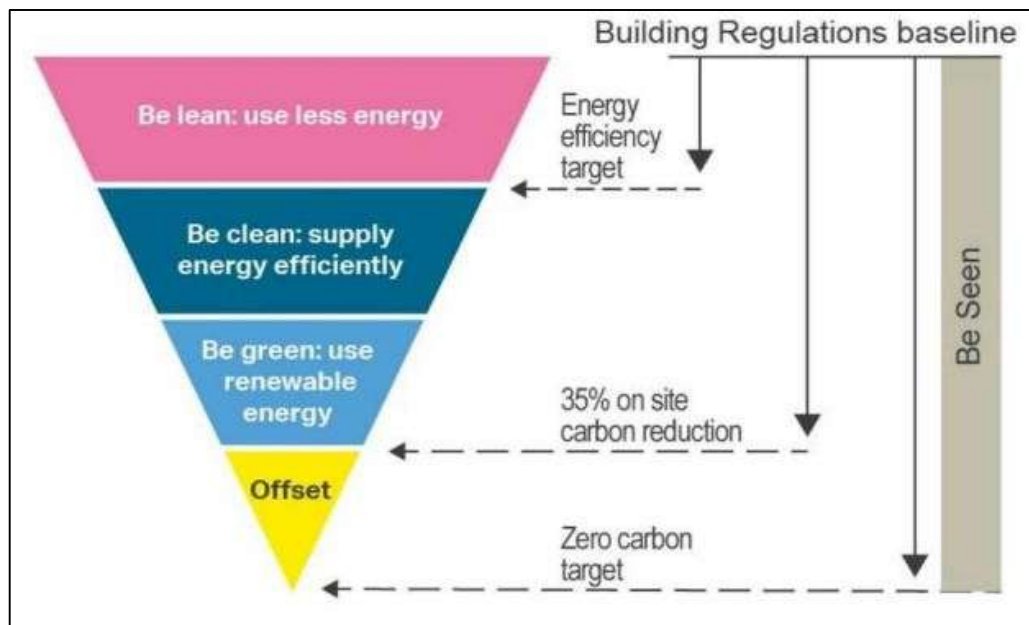
2. METHODOLOGY

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 notional specifications (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) 2024

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, iv) 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 ii) 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.

Haringey's Local Plan Strategic Policies 2013-2026

STRATEGIC POLICY SP0: Presumption in Favour of Sustainable Development

When considering development proposals, the Council will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework (NPPF). The Council will always work proactively with applicants to find solutions, which mean that proposals can be approved wherever possible and to secure development that improves the economic social and environmental conditions in Haringey. Planning applications that accord with the policies in Haringey's Local Plan (and, where relevant, with policies in neighbourhood plans) will be approved without delay, unless material considerations indicate otherwise.

Where there are no policies relevant to the application or relevant policies are out of date at the time of making the decision, then the Council will grant permission unless material considerations indicate otherwise taking into account whether:

- Any adverse impacts of granting permission would significantly and demonstrably outweigh the benefits, when assessed against the policies of the NPPF taken as a whole; or
- Specific policies in the NPPF indicate

STRATEGIC POLICY SP4: Working Towards a Low Carbon Haringey

The Council will work with partners too:

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 developments will achieve a minimum 25% reduction in total (regulated) CO₂ emissions in line with Code for Sustainable Homes Level 4 energy standards, and should aim to achieve Level 6. All new residential developments shall be zero carbon from 2016 onwards; and
2. The Council will promote low- and zero-carbon energy generation through the following measures:
 - a) Requiring all developments to assess, identify and implement, where viable, site-wide and area-wide decentralised energy facilities including the potential to link into a wider network;

- b) Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connections to existing or planned networks where feasible;
- c) Working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks including the potential in the Upper Lee Valley Opportunity Area;
- d) All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from onsite renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.

SP5: Water Management and Flooding

The Council will require all developments 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;

STRATEGIC POLICY 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:

- Safeguard existing waste sites unless compensatory provision is made;
- 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; and
- Continue working with its partners in the North London Waste Authority to adopt the North London Waste Plan (NLWP) which has identified locations suitable for waste management facilities to meet the London Plan apportionment of 1.9 2.1m tonnes and the Haringey apportionment of 237,000 182,000 tonnes.

STRATEGIC POLICY SP11: Design

All new development should enhance and enrich Haringey's built environment and create places and buildings that are high quality, attractive, sustainable, safe and easy to use. To achieve this all development shall:

- Be of the highest standard of design that respects its local context and character and historic significance, to contribute to the creation and enhancement of Haringey's sense of place and identity;
- Ensure impacts on health, climate change, natural resources and biodiversity are minimised by adopting and improving sustainable design and construction techniques;
- Incorporate solutions to reduce crime and the fear of crime, such as promoting social inclusion; creating well-connected and high quality public realm that is easy and safe to use; and by applying the principles set out in 'Secured by Design' and Safer Places;
- Promote high quality landscaping on and off site, including improvements to existing streets and public spaces;
- Seek the highest standards of access in all buildings and places; and
- Ensure buildings are designed to be flexible and adaptable – and able to integrate services and functions.

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 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 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	0.5	
After Energy Demand Reduction (Be Lean)	0.1	
After Heat Network Connection (Be Clean)	0.1	
After Renewables (Be Green)	0.1	

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	0.4	73
Be Clean: Savings from Heat Network	0.0	0
Be Green: Savings from Renewable Energy	0.1	15
Cumulative on-site savings	0.5	87
Annual savings from off-set payment	0.1	
(Tonnes CO ₂)		
Cumulative savings for off-set payment	2	
Cash in-lieu contribution (£)	195	

a. Baseline Model

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

The baseline model used for this project assumed that any heating and hot water supply would be provided by a gas boiler 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 **73%** 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	0.17W/m ² k
Roof	0.11 W/m ² k	0.10 W/m ² k
Floor	0.13 W/m ² k	0.12 W/m ² k
Windows & Doors	1.2 W/m ² k	1.2 W/ m ² k
Rooflights	1.7 W/m ² k	1.2 W/m ² k

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	47.81	42.90	10

Air Permeability – designed to achieve an air permeability score of 4.

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 dMEV is proposed for the dwelling.

Space Heating & Cooling - Space heating will be provided by radiators heating and an ASHP.

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

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	11.10	28.15	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

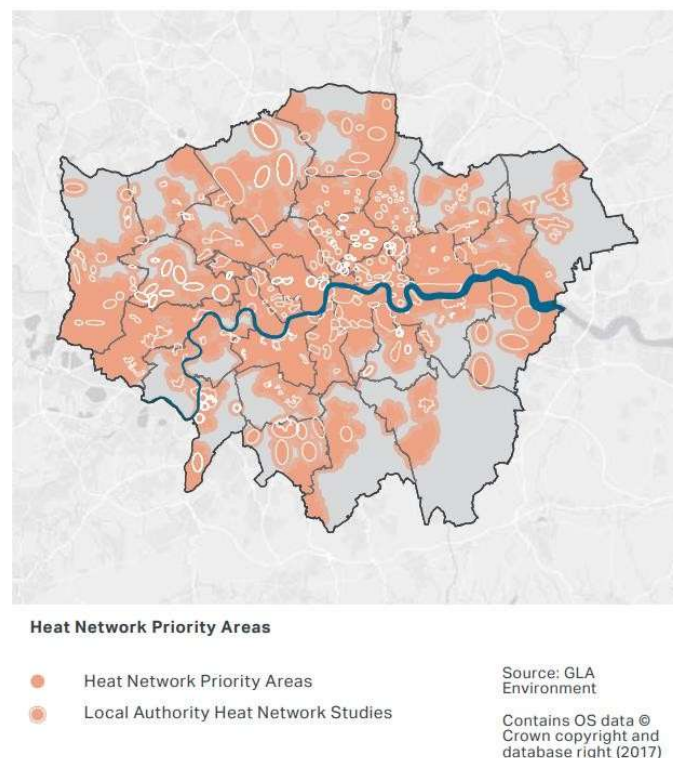
- A. Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.
- B. 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. However, the development will be built ready to accommodate District Heating and Cooling should a local network be introduced in the future.

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 ASHP and PV Panels is to be incorporated in the design because it achieves a CO₂ percentage reduction of **15%** contributing to an overall reduction of **87%** in carbon emissions.

Table 7. Photovoltaic Panels

SystemSize	Orientation	Degree	Panels
2 kWp	South	Horizontal	4-5 (approx)

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.

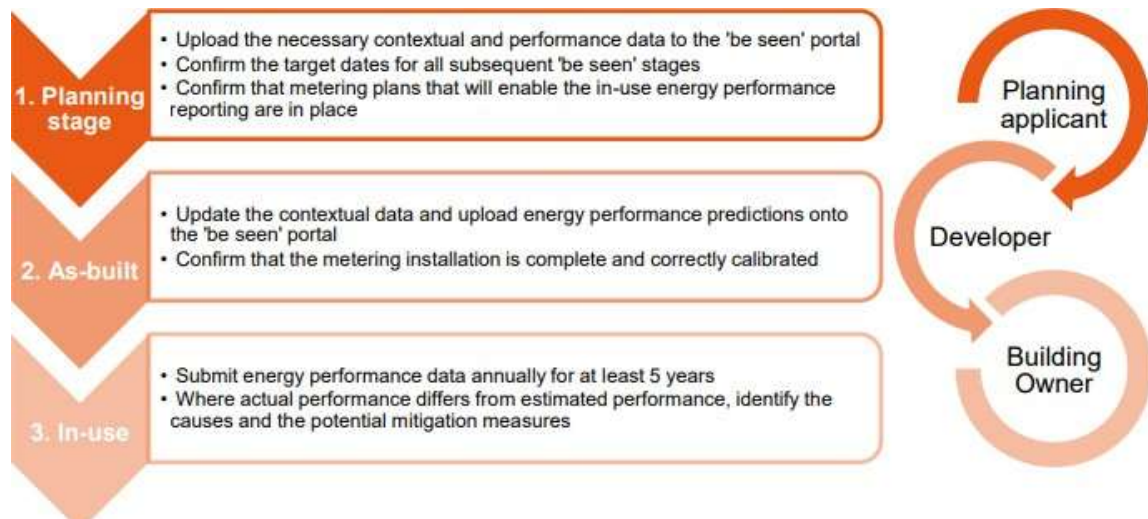
1.2.3 The 'be seen' policy establishes post-construction monitoring as good practice, enabling developers and building owners to better understand their buildings and identify methods for improving energy performance from the project inception stage and throughout the building's lifetime.

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

As the house is predicted to achieve an EPC rating of B88, the operational running costs will be low due to the high performance. As the development includes renewable technologies it is less reliant on the main grid and will protect the consumer from high prices.

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 project aims to meet the sustainability objectives set out in the National Planning Framework 2023.

Materials Efficiency

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

b. Overheating Strategy

Policy SI 4 Managing Heat Risk

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

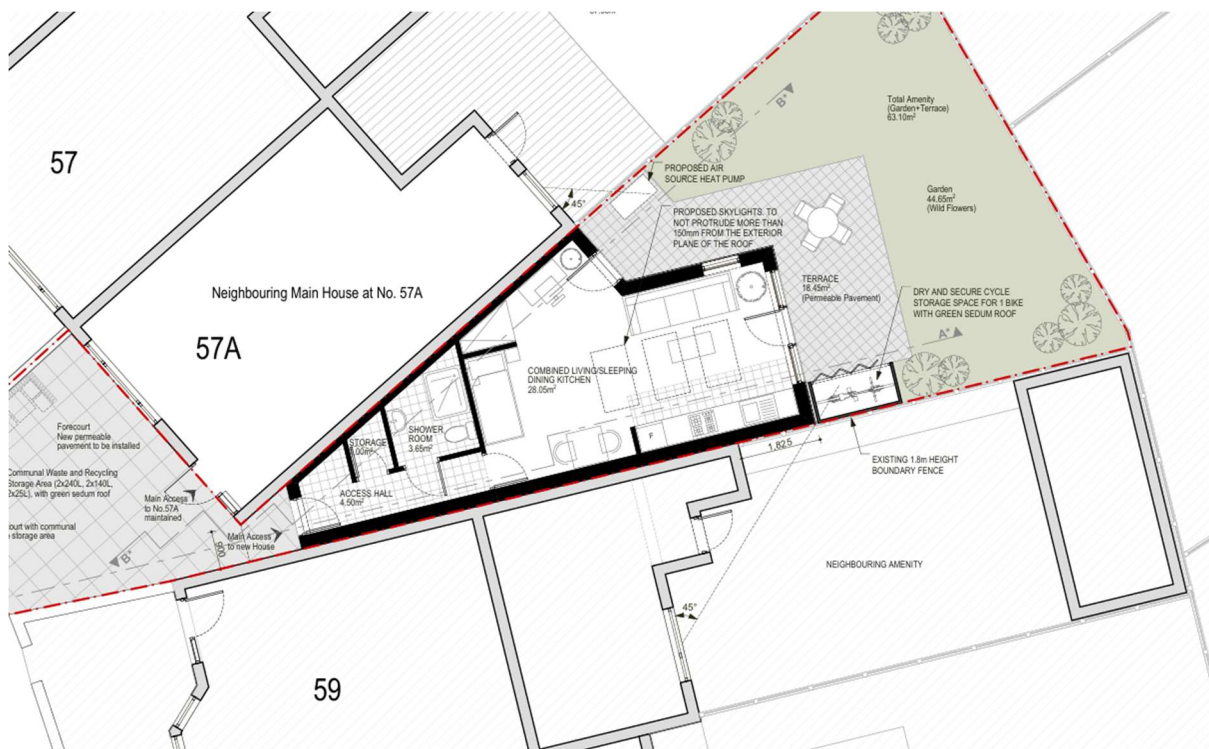
Minimise Heat Generation Through Energy Efficient Design

Through the use of passive and active design measures, the design team have enabled the development to require less energy through the use of optimised insulation, cross ventilation, improved window u-values, higher air tightness and reduced cold bridging. The GHA Overheating Tool has been completed and can be found in the Appendix. The tool showed a low risk of overheating.

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. 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 8. Water Fittings Standards

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

d. Pollution: Light, Air and Noise

Light

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

Air and Noise

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

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

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

Other measures will include:

- 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.

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

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

f. Flood Risk

The development site is located in a Very 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 existing garden will be subdivided so the new house has its own garden. The new building footprint replaces the existing extension footprint and is therefore only covering existing paved areas. The existing garden is mostly grass with some perimeter shrubs which will all remain. Biodiversity is therefore encouraged and remains on site. Some new landscaping and planting is to be added prior to occupation.

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 **73%** from the notional emissions once energy efficiency measures and lean measures are taken into account.

The use of an ASHP and PV panels are to be incorporated in the design because they achieve a CO₂ percentage reduction of **15%** contributing to the overall reduction of **87%** 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



Plot Reference	Baseline	Issued on Date	02/09/2026
Assessment Reference	00001	Plot Type Ref	
Plot Address		SAP Version	10.2
SAP Rating	72 C	DER	9.82
Environmental	94 A	% DER < TER	14.38
CO ₂ Emissions (t/year)	0.34	DFEE	47.03
Compliance Check	See BREL	TFEE	47.81
% DPER < TPER	-34.62	% DFEE < TFEE	1.62
		DPER	103.32
		TPER	76.75
Assessor Details	Miss Charlotte Russell	Assessor ID	DK97-0001
Client	Arch, Architectural Design Studio		

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	38.0400 (1b)	2.5000 (2b)	95.1000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		95.1000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	95.1000 (5)

2. Ventilation rate

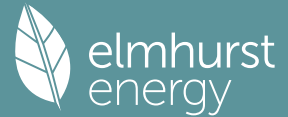
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.2103 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4603 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3913 (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	0.4989	0.4891	0.4793	0.4304	0.4206	0.3717	0.3717	0.3619	0.3913	0.4206	0.4402	0.4597 (22b)
Effective ac	0.6244	0.6196	0.6149	0.5926	0.5885	0.5691	0.5691	0.5655	0.5765	0.5885	0.5969	0.6057 (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
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)
Solid Door			1.6200	1.2000	1.9440		(26)
Rooflights			3.3600	1.5918	5.3483		(27a)
Heatloss Floor			38.0400	0.1300	4.9452	110.0000	4184.4000 (28a)
External Wall	27.5100	11.7400	15.7700	0.1800	2.8386	110.0000	1734.7000 (29a)
Flat Roof	38.0400	3.3600	34.6800	0.1100	3.8148	9.0000	312.1200 (30)
Total net area of external elements Aum(A, m ²)			103.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.4787		(33)
Main dwelling							
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000 (32)
Internal Wall			20.7100			9.0000	186.3900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							9641.8100 (34)
List of Thermal Bridges							253.4650 (35)
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				4.9400	0.0180		0.0889
E3 Sill				2.5100	0.0160		0.0402
E4 Jamb				28.4000	0.0110		0.3124
E5 Ground floor (normal)				11.0100	0.0710		0.7817

Full SAP Calculation Printout



E14 Flat roof	11.0100	0.0400	0.4404										
E16 Corner (normal)	12.5000	0.0510	0.6375										
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.1040	-0.2600										
P1 Party wall - Ground floor	18.4300	0.0440	0.8109										
P4 Party wall - Roof (insulation at ceiling level)	18.4300	0.0400	0.7372										
R1 Head of roof window	2.3900	0.2400	0.5736										
R2 Sill of roof window	3.0200	0.2400	0.7248										
R3 Jamb of roof window	8.4000	0.2400	2.0160										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.9036 (36)									
Point Thermal bridges			(36a) =	0.0000									
Total fabric heat loss		(33) + (36) + (36a) =		37.3823 (37)									
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 19.5964	Feb 19.4448	Mar 19.2962	Apr 18.5981	May 18.4674	Jun 17.8594	Jul 17.8594	Aug 17.7468	Sep 18.0936	Oct 18.4674	Nov 18.7317	Dec 19.0079	(38)
Heat transfer coeff	56.9787	56.8271	56.6785	55.9804	55.8498	55.2417	55.2417	55.1291	55.4759	55.8498	56.1140	56.3902	(39)
Average = Sum(39)m / 12 =												55.9797	
HLP	Jan 1.4979	Feb 1.4939	Mar 1.4900	Apr 1.4716	May 1.4682	Jun 1.4522	Jul 1.4522	Aug 1.4492	Sep 1.4584	Oct 1.4682	Nov 1.4751	Dec 1.4824	(40)
HLP (average)												1.4716	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

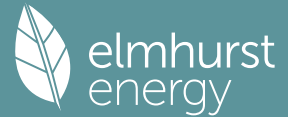
Assumed occupancy													1.3553 (42)
Hot water usage for mixer showers	46.9429	46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630	(42a)
Hot water usage for baths	20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415	(42b)
Hot water usage for other uses	28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093	(42c)
Average daily hot water use (litres/day)												88.0281	(43)
Daily hot water use	Jan 95.7624	Feb 93.7186	Mar 91.2291	Apr 87.4424	May 84.3677	Jun 81.0620	Jul 79.7907	Aug 82.2694	Sep 84.8837	Oct 88.3542	Nov 92.1994	Dec 95.5139	(44)
Energy conte	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516	(45)
Energy content (annual)										Total = Sum(45)m =		1462.1279	
Distribution loss (46)m = 0.15 x (45)m	22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327	(46)
Water storage loss (or HIU loss):													
Store volume												100.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.4040	(55)
Total storage loss	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	(56)
If cylinder contains dedicated solar storage	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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	250.0458	222.3148	238.5974	214.9122	211.9568	164.3072	163.2863	168.6531	169.3021	218.2775	226.5629	247.9332	(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	250.0458	222.3148	238.5974	214.9122	211.9568	164.3072	163.2863	168.6531	169.3021	218.2775	226.5629	247.9332	(64)
								Total per year (kWh/year) = Sum(64)m =				2496.1495	(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	94.3144	84.0125	90.5078	82.2721	81.6498	51.1516	50.6962	52.4806	52.8124	83.7515	86.1459	93.6120	(65)

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

Metabolic gains (Table 5), Watts	Jan 81.3164	Feb 81.3164	Mar 81.3164	Apr 81.3164	May 81.3164	Jun 81.3164	Jul 81.3164	Aug 81.3164	Sep 81.3164	Oct 81.3164	Nov 81.3164	Dec 81.3164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.1299	38.3076	31.1539	23.5855	17.6304	14.8843	16.0831	20.9054	28.0591	35.6275	41.5826	44.3286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	(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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	(71)
Water heating gains (Table 5)	126.7667	125.0186	121.6503	114.2667	109.7444	71.0439	68.1400	70.5384	73.3506	112.5692	119.6471	125.8226	(72)
Total internal gains	418.5748	413.8109	398.7366	374.0935	351.3827	295.4385	286.0522	291.4665	305.9846	365.4627	390.7291	411.1483	(73)

6. Solar gains													
[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF	Access factor Table 6d	Gains W						
North	1.6200	10.6334	0.6300	0.7000	0.7700	5.2645	(74)						
East	8.5000	19.6403	0.6300	0.7000	0.7700	51.0197	(76)						
North	3.3600	26.0000	0.6300	0.7000	1.0000	34.6732	(82)						
Solar gains	90.9574	181.8797	309.4850	467.2146	586.8215	607.0553	575.3343	484.6456	365.0803	218.4201	114.1183	74.3502	(83)
Total gains	509.5322	595.6906	708.2216	841.3081	938.2041	902.4938	861.3865	776.1120	671.0649	583.8828	504.8474	485.4984	(84)

Full SAP Calculation Printout



7. Mean internal temperature (heating season)

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

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	47.0049	47.1303	47.2539	47.8432	47.9551	48.4829	48.4829	48.5820	48.2782	47.9551	47.7293	47.4955	21.0000 (85)
alpha	4.1337	4.1420	4.1503	4.1895	4.1970	4.2322	4.2322	4.2388	4.2185	4.1970	4.1820	4.1664	
util living area	0.9634	0.9337	0.8607	0.7114	0.5319	0.3872	0.2812	0.3248	0.5462	0.8055	0.9361	0.9689	(86)
MIT	20.0190	20.2192	20.5074	20.7705	20.8862	20.9188	20.9253	20.9241	20.8945	20.7078	20.3190	19.9851	(87)
Th 2	19.6891	19.6921	19.6950	19.7089	19.7114	19.7235	19.7235	19.7258	19.7189	19.7114	19.7062	19.7007	(88)
util rest of house	0.9527	0.9157	0.8271	0.6573	0.4655	0.3120	0.2001	0.2358	0.4545	0.7484	0.9154	0.9597	(89)
MIT 2	18.8443	19.0365	19.3013	19.5321	19.6167	19.6477	19.6502	19.6523	19.6324	19.4957	19.1480	18.8215	(90)
Living area fraction									fLA = Living area / (4) =				0.3373 (91)
MIT	19.2405	19.4354	19.7081	19.9498	20.0449	20.0764	20.0803	20.0812	20.0581	19.9045	19.5430	19.2140	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2405	19.4354	19.7081	19.9498	20.0449	20.0764	20.0803	20.0812	20.0581	19.9045	19.5430	19.2140	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9482	0.9115	0.8275	0.6679	0.4831	0.3330	0.2229	0.2608	0.4796	0.7579	0.9123	0.9554	(94)
Useful gains	483.1253	542.9868	586.0611	561.9430	453.2785	300.5495	191.9955	202.4342	321.8578	442.4961	460.5744	463.8606	(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	851.2905	826.0058	748.6152	618.5700	466.0584	302.5262	192.2572	202.9433	330.5293	519.6542	698.2240	846.6401	(97)
Space heating kWh	273.9149	190.1888	120.9403	40.7715	9.5083	0.0000	0.0000	0.0000	0.0000	57.4056	171.1077	284.7880	(98a)
Space heating requirement - total per year (kWh/year)												1148.6251	
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	273.9149	190.1888	120.9403	40.7715	9.5083	0.0000	0.0000	0.0000	0.0000	57.4056	171.1077	284.7880	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1148.6251	
Space heating per m2										(98c) / (4) =		30.1952	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)

Fraction of space heat from main system(s)

Efficiency of main space heating system 1 (in %)

Efficiency of main space heating system 2 (in %)

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	273.9149	190.1888	120.9403	40.7715	9.5083	0.0000	0.0000	0.0000	0.0000	57.4056	171.1077	284.7880	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	161.1264	111.8758	71.1414	23.9832	5.5931	0.0000	0.0000	0.0000	0.0000	33.7680	100.6516	167.5223	(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	250.0458	222.3148	238.5974	214.9122	211.9568	164.3072	163.2863	168.6531	169.3021	218.2775	226.5629	247.9332	(64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kWh/month	147.0858	130.7734	140.3514	126.4190	124.6804	96.6513	96.0508	99.2077	99.5895	128.3985	133.2723	145.8431	(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	37.7514	30.2856	27.2688	19.9783	15.4318	12.6079	14.0774	18.2983	23.7677	31.1846	35.2229	38.8006	(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												675.6618	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1468.3232	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year

Electricity for lighting (calculated in Appendix L)

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

PV generation

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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	2448.6603 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	675.6618	16.4900	111.4166 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1468.3232	16.4900	242.1265 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	304.6752	16.4900	50.2409 (250)
Additional standing charges			0.0000 (251)
Total energy cost			403.7841 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	1.7505 (257)
SAP value	71.6242
SAP rating (Section 12)	72 (258)
SAP band	C

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	675.6618	0.1573	106.3132 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1468.3232	0.1415	207.7879 (264)
Space and water heating			314.1012 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	304.6752	0.1443	43.9741 (268)
Total CO2, kg/year			358.0752 (272)
CO2 emissions per m2			9.4100 (273)
EI value			94.2218
EI rating			94 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	38.0400 (1b)	x 2.5000 (2b)	= 95.1000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 95.1000 (5)

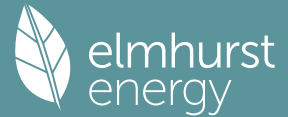
2. Ventilation rate

	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) =	0.2103 (8)
Pressure Test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4603	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3913 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate												

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Effective ac	0.4695	0.4402	0.4304	0.3815	0.3815	0.3521	0.3619	0.3424	0.3619	0.3913	0.4010	0.4304 (22b)
	0.6102	0.5969	0.5926	0.5728	0.5728	0.5620	0.5655	0.5586	0.5655	0.5765	0.5804	0.5926 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			10.1200	1.1450	11.5878			(27)
Solid Door			1.6200	1.2000	1.9440			(26)
Rooflights			3.3600	1.5918	5.3483			(27a)
Heatloss Floor			38.0400	0.1300	4.9452	110.0000	4184.4000	(28a)
External Wall	27.5100	11.7400	15.7700	0.1800	2.8386	110.0000	1734.7000	(29a)
Flat Roof	38.0400	3.3600	34.6800	0.1100	3.8148	9.0000	312.1200	(30)
Total net area of external elements Aum(A, m2)			103.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.4787			(33)
Main dwelling								
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000	(32)
Internal Wall			20.7100			9.0000	186.3900	(32c)
Heat capacity Cm = Sum(A x k)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					(28)...(30) + (32) + (32a)...(32e) =		9641.8100	(34)
List of Thermal Bridges							253.4650	(35)

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	4.9400	0.0180	0.0889	
E3 Sill	2.5100	0.0160	0.0402	
E4 Jamb	28.4000	0.0110	0.3124	
E5 Ground floor (normal)	11.0100	0.0710	0.7817	
E14 Flat roof	11.0100	0.0400	0.4404	
E16 Corner (normal)	12.5000	0.0510	0.6375	
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.1040	-0.2600	
P1 Party wall - Ground floor	18.4300	0.0400	0.8109	
P4 Party wall - Roof (insulation at ceiling level)	18.4300	0.0400	0.7372	
R1 Head of roof window	2.3900	0.2400	0.5736	
R2 Sill of roof window	3.0200	0.2400	0.7248	
R3 Jamb of roof window	8.4000	0.2400	2.0160	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.9036 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	37.3823 (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	
19.1505	18.7317	18.5981	17.9750	17.9750	17.6372	17.7468	17.5306	17.7468	18.0936	18.2152	18.5981	(38)
Heat transfer coeff												
56.5329	56.1140	55.9804	55.3573	55.3573	55.0195	55.1291	54.9129	55.1291	55.4759	55.5975	55.9804	(39)
Average = Sum(39)m / 12 =												55.5489
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.4861	1.4751	1.4716	1.4552	1.4552	1.4464	1.4492	1.4436	1.4492	1.4584	1.4616	1.4716	(40)
HLP (average)												1.4603
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

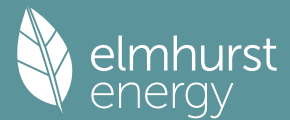
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3553 (42)
Hot water usage for mixer showers													
46.9429	46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630	(42a)	
Hot water usage for baths													
20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415	(42b)	
Hot water usage for other uses													
28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093	(42c)	
Average daily hot water use (litres/day)												88.0281 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
95.7624	93.7186	91.2291	87.4424	84.3677	81.0620	79.7907	82.2694	84.8837	88.3542	92.1994	95.5139	(44)	
Energy content (annual)	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1462.1279	
22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327	(46)	
Water storage loss (or HIU loss):													
Store volume												100.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.8000 (48)	
Temperature factor from Table 2b												0.7800 (49)	
Enter (49) or (54) in (55)												1.4040 (55)	
Total storage loss													
43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	(56)	
If cylinder contains dedicated solar storage													
43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240	(57)	
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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													
250.0458	222.3148	238.5974	214.9122	211.9568	164.3072	163.2863	168.6531	169.3021	218.2775	226.5629	247.9332	(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													
250.0458	222.3148	238.5974	214.9122	211.9568	164.3072	163.2863	168.6531	169.3021	218.2775	226.5629	247.9332	(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													
94.3144	84.0125	90.5078	82.2721	81.6498	51.1516	50.6962	52.4806	52.8124	83.7515	86.1459	93.6120	(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
81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	43.1299	38.3076	31.1539	23.5855	17.6304	14.8843	16.0831	20.9054	28.0591	35.6275	41.5826	44.3286 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047 (68)
Pumps, fans	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869 (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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109 (71)
Total internal gains	126.7667	125.0186	121.6503	114.2667	109.7444	71.0439	68.1400	70.5384	73.3506	112.5692	119.6471	125.8226 (72)
	418.5748	413.8109	398.7366	374.0935	351.3827	295.4385	286.0522	291.4665	305.9846	365.4627	390.7291	411.1483 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					1.6200	12.7054	0.6300	0.7000			0.7700	6.2903 (74)
East					8.5000	23.7288	0.6300	0.7000			0.7700	61.6406 (76)
North					3.3600	32.0000	0.6300	0.7000			1.0000	42.6747 (82)
Solar gains	110.6056	196.6486	332.5704	526.5145	633.1722	698.8203	655.1454	559.0578	419.2407	252.3878	140.1454	87.4143 (83)
Total gains	529.1804	610.4595	731.3070	900.6080	984.5548	994.2588	941.1976	850.5242	725.2253	617.8505	530.8745	498.5626 (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	47.3756	47.7293	47.8432	48.3817	48.3817	48.6787	48.5820	48.7732	48.5820	48.2782	48.1727	47.8432
alpha	4.1584	4.1820	4.1895	4.2254	4.2254	4.2452	4.2388	4.2515	4.2388	4.2185	4.2115	4.1895
util living area	0.9523	0.9207	0.8315	0.6497	0.4616	0.3084	0.2106	0.2257	0.4471	0.7294	0.9075	0.9584 (86)
MIT	20.1361	20.3074	20.5902	20.8248	20.9060	20.9243	20.9267	20.9268	20.9141	20.7975	20.4606	20.1226 (87)
Th 2	19.6979	19.7062	19.7089	19.7212	19.7212	19.7280	19.7258	19.7301	19.7258	19.7189	19.7165	19.7089 (88)
util rest of house	0.9384	0.8995	0.7927	0.5923	0.3953	0.2391	0.1362	0.1440	0.3562	0.6585	0.8782	0.9457 (89)
MIT 2	18.9645	19.1313	19.3859	19.5840	19.6382	19.6543	19.6528	19.6574	19.6485	19.5704	19.2875	18.9618 (90)
Living area fraction	19.3597	19.5280	19.7921	20.0025	20.0658	20.0827	20.0825	20.0855	20.0754	19.9843	19.6832	19.3533 (92)
MIT	19.3597	19.5280	19.7921	20.0025	20.0658	20.0827	20.0825	20.0855	20.0754	19.9843	19.6832	19.3533 (93)
Temperature adjustment												0.0000
adjusted MIT	19.3597	19.5280	19.7921	20.0025	20.0658	20.0827	20.0825	20.0855	20.0754	19.9843	19.6832	19.3533 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9340	0.8961	0.7955	0.6055	0.4135	0.2585	0.1571	0.1669	0.3816	0.6743	0.8773	0.9415 (94)
Ext temp.	494.2539	547.0149	581.7423	545.2973	407.0995	257.0193	147.8333	141.9189	276.7472	416.6268	465.7320	469.3817 (95)
Heat loss rate W	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Space heating kWh	811.7940	792.7761	710.5076	581.3897	413.2882	257.6378	147.8821	141.9774	279.8010	459.5769	643.9949	792.3081 (97)
Space heating requirement - total per year (kWh/year)	236.2498	165.1515	95.8014	25.9865	4.6043	0.0000	0.0000	0.0000	0.0000	31.9548	128.3493	240.2573 (98a)
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)	236.2498	165.1515	95.8014	25.9865	4.6043	0.0000	0.0000	0.0000	0.0000	31.9548	128.3493	240.2573 (98c)
Space heating requirement after solar 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 (99)
Space heating per m2												

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 %)	170.0000 (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)	236.2498	165.1515	95.8014	25.9865	4.6043	0.0000	0.0000	0.0000	0.0000	31.9548	128.3493	240.2573 (98)
Space heating fuel (main heating system)	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (210)
Space heating efficiency (main heating system 2)	138.9705	97.1479	56.3538	15.2862	2.7084	0.0000	0.0000	0.0000	0.0000	18.7970	75.4996	141.3278 (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 requirement	250.0458	222.3148	238.5974	214.9122	211.9568	164.3072	163.2863	168.6531	169.3021	218.2775	226.5629	247.9332 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	147.0858	130.7734	140.3514	126.4190	124.6804	96.6513	96.0508	99.2077	99.5895	128.3985	133.2723	145.8431 (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)

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Lighting	37.7514	30.2856	27.2688	19.9783	15.4318	12.6079	14.0774	18.2983	23.7677	31.1846	35.2229	38.8006	(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												546.0912	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1468.3232	(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)												304.6752	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2319.0896	(238)

10a. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	546.0912	27.6700	151.1034	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1468.3232	27.6700	406.2850	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	304.6752	27.6700	84.3036	(250)
Additional standing charges			0.0000	(251)
Total energy cost			641.6921	(255)

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	546.0912	0.1581	86.3547	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1468.3232	0.1415	207.7879	(264)
Space and water heating			294.1426	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	304.6752	0.1443	43.9741	(268)
Total CO2, kg/year			338.1167	(272)

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	546.0912	1.5854	865.7542	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1468.3232	1.5233	2236.7190	(278)
Space and water heating			3102.4732	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	304.6752	1.5338	467.3210	(282)
Total Primary energy kWh/year			3569.7943	(286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: C 72
Current environmental impact rating: A 94

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 3.3	-£ 94	-43 kg (12.7%)
U Solar photovoltaic panels	+ 8.4	-£ 210	-103 kg (35.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
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Solar water heating	£94	1.13 kg/m ²	C 75	A 95
Solar photovoltaic panels	£210	2.71 kg/m ²	B 83	A 96
Total Savings	£305	3.84 kg/m ²		

Potential energy efficiency rating: B 83
 Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 597 TEST (31 Jul 2026)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £642	Potential £547	Saving £94
Electricity			
Space heating	£151	£173	-£22
Water heating	£406	£290	£117
Lighting	£84	£84	£0
Generated (PV)	-£0	-£210	£210
Total cost of fuels	£642	£337	£304
Total cost of uses	£641	£337	£305
Delivered energy	61 kWh/m ²	32 kWh/m ²	29 kWh/m ²
Carbon dioxide emissions	0.3 tonnes	0.2 tonnes	0.1 tonnes
CO2 emissions per m ²	9 kg/m ²	5 kg/m ²	4 kg/m ²
Primary energy	94 kWh/m ²	51 kWh/m ²	43 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
 CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	38.0400 (1b)	x 2.5000 (2b)	= 95.1000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 95.1000 (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) =	0.2103 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4603	(18)
Number of sides sheltered		2	(19)

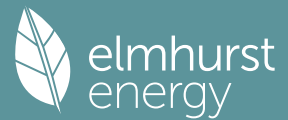
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3913	(21)

	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
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
Adj infilt rate	0.4989	0.4891	0.4793	0.4304	0.4206	0.3717	0.3717	0.3619	0.3913	0.4206	0.4402	0.4597
Effective ac	0.6244	0.6196	0.6149	0.5926	0.5885	0.5691	0.5691	0.5655	0.5765	0.5885	0.5969	0.6057

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
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)
Solid Door			1.6200	1.2000	1.9440		(26)
Rooflights			3.3600	1.5918	5.3483		(27a)
Heatloss Floor			38.0400	0.1300	4.9452	110.0000	4184.4000 (28a)
External Wall	27.5100	11.7400	15.7700	0.1800	2.8386	110.0000	1734.7000 (29a)
Flat Roof	38.0400	3.3600	34.6800	0.1100	3.8148	9.0000	312.1200 (30)
Total net area of external elements Aum(A, m ²)			103.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4787		(33)
Main dwelling							
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000 (32)
Internal Wall			20.7100			9.0000	186.3900 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9641.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							253.4650 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				4.9400	0.0180	0.0889	

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E3 Sill	2.5100	0.0160	0.0402
E4 Jamb	28.4000	0.0110	0.3124
E5 Ground floor (normal)	11.0100	0.0710	0.7817
E14 Flat roof	11.0100	0.0400	0.4404
E16 Corner (normal)	12.5000	0.0510	0.6375
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.1040	-0.2600
P1 Party wall - Ground floor	18.4300	0.0440	0.8109
P4 Party wall - Roof (insulation at ceiling level)	18.4300	0.0400	0.7372
R1 Head of roof window	2.3900	0.2400	0.5736
R2 Sill of roof window	3.0200	0.2400	0.7248
R3 Jamb of roof window	8.4000	0.2400	2.0160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.9036 (36)
Point Thermal Bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	37.3823 (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	19.5964	19.4448	19.2962	18.5981	18.4674	17.8594	17.8594	17.7468	18.0936	18.4674	18.7317	19.0079 (38)
Average = Sum(39)m / 12 =	56.9787	56.8271	56.6785	55.9804	55.8498	55.2417	55.2417	55.1291	55.4759	55.8498	56.1140	56.3902 (39)
												55.9797
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4979	1.4939	1.4900	1.4716	1.4682	1.4522	1.4522	1.4492	1.4584	1.4682	1.4751	1.4824 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

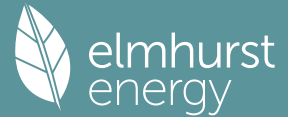
4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3553 (42)
Hot water usage for mixer showers	46.9429	46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630 (42a)
Hot water usage for baths	20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415 (42b)
Hot water usage for other uses	28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093 (42c)
Average daily hot water use (litres/day)												88.0281 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516 (44)
Energy content (annual)												1462.1279 (45)
Distribution loss (46)m = 0.15 x (45)m	22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327 (46)
Water storage loss (or HIU loss):												
Store volume												100.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.4040 (55)
Total storage loss	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (56)
If cylinder contains dedicated solar storage	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	52.5120	53.2624	54.8576	53.0880	54.8576	53.0880	54.8576 (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	250.0458	222.3148	238.5974	214.9122	211.9568	164.3072	163.2863	168.6531	169.3021	218.2775	226.5629	247.9332 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												613.0407 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												613.0407
Solar input	-0.0000	-16.2267	-57.9151	-80.0773	-105.8845	-93.4612	-93.0399	-81.4666	-56.3209	-28.6484	-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	250.0458	206.0881	180.6822	134.8349	106.0723	70.8460	70.2464	87.1865	112.9812	189.6291	226.5629	247.9332 (64)
												Total per year (kWh/year) = Sum(64)m = 1883.1087 (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	94.3144	84.0125	90.5078	82.2721	81.6498	51.1516	50.6962	52.4806	52.8124	83.7515	86.1459	93.6120 (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	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.1299	38.3076	31.1539	23.5855	17.6304	14.8843	16.0831	20.9054	28.0591	35.6275	41.5826	44.3286 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869 (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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109 (71)
Water heating gains (Table 5)	126.7667	125.0186	121.6503	114.2667	109.7444	71.0439	68.1400	70.5384	73.3506	112.5692	119.6471	125.8226 (72)
Total internal gains	418.5748	413.8109	398.7366	374.0935	351.3827	295.4385	286.0522	291.4665	305.9846	365.4627	390.7291	411.1483 (73)

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					1.6200	10.6334	0.6300	0.7000			0.7700	5.2645 (74)
East					8.5000	19.6403	0.6300	0.7000			0.7700	51.0197 (76)
North					3.3600	26.0000	0.6300	0.7000			1.0000	34.6732 (82)
Solar gains	90.9574	181.8797	309.4850	467.2146	586.8215	607.0553	575.3343	484.6456	365.0803	218.4201	114.1183	74.3502 (83)
Total gains	509.5322	595.6906	708.2216	841.3081	938.2041	902.4938	861.3865	776.1120	671.0649	583.8828	504.8474	485.4984 (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	47.0049	47.1303	47.2539	47.8432	47.9551	48.4829	48.4829	48.5820	48.2782	47.9551	47.7293	47.4955	
alpha	4.1337	4.1420	4.1503	4.1895	4.1970	4.2322	4.2322	4.2388	4.2185	4.1970	4.1820	4.1664	
util living area	0.9634	0.9337	0.8607	0.7114	0.5319	0.3872	0.2812	0.3248	0.5462	0.8055	0.9361	0.9689 (86)	
MIT	20.0190	20.2192	20.5074	20.7705	20.8862	20.9188	20.9253	20.9241	20.8945	20.7078	20.3190	19.9851 (87)	
Th 2	19.6891	19.6921	19.6950	19.7089	19.7114	19.7235	19.7235	19.7258	19.7189	19.7114	19.7062	19.7007 (88)	
util rest of house	0.9527	0.9157	0.8271	0.6573	0.4655	0.3120	0.2001	0.2358	0.4545	0.7484	0.9154	0.9597 (89)	
MIT 2	18.8443	19.0365	19.3013	19.5321	19.6167	19.6477	19.6502	19.6523	19.6324	19.4957	19.1480	18.8215 (90)	
Living area fraction									fLA = Living area / (4) =				0.3373 (91)
MIT	19.2405	19.4354	19.7081	19.9498	20.0449	20.0764	20.0803	20.0812	20.0581	19.9045	19.5430	19.2140 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.2405	19.4354	19.7081	19.9498	20.0449	20.0764	20.0803	20.0812	20.0581	19.9045	19.5430	19.2140 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9482	0.9115	0.8275	0.6679	0.4831	0.3330	0.2229	0.2608	0.4796	0.7579	0.9123	0.9554 (94)
Useful gains	483.1253	542.9868	586.0611	561.9430	453.2785	300.5495	191.9955	202.4342	321.8578	442.4961	460.5744	463.8606 (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	851.2905	826.0058	748.6152	618.5700	466.0584	302.5262	192.2572	202.9433	330.5293	519.6542	698.2240	846.6401 (97)
Space heating kWh	273.9149	190.1888	120.9403	40.7715	9.5083	0.0000	0.0000	0.0000	0.0000	57.4056	171.1077	284.7880 (98a)
Space heating requirement - total per year (kWh/year)												1148.6251
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	273.9149	190.1888	120.9403	40.7715	9.5083	0.0000	0.0000	0.0000	0.0000	57.4056	171.1077	284.7880 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1148.6251
Space heating per m ²										(98c) / (4) =		30.1952 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	273.9149	190.1888	120.9403	40.7715	9.5083	0.0000	0.0000	0.0000	0.0000	57.4056	171.1077	284.7880 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	161.1264	111.8758	71.1414	23.9832	5.5931	0.0000	0.0000	0.0000	0.0000	33.7680	100.6516	167.5223 (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	250.0458	206.0881	180.6822	134.8349	106.0723	70.8460	70.2464	87.1865	112.9812	189.6291	226.5629	247.9332 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	147.0858	121.2283	106.2837	79.3146	62.3954	41.6741	41.3214	51.2862	66.4595	111.5465	133.2723	145.8431 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	37.7514	30.2856	27.2688	19.9783	15.4318	12.6079	14.0774	18.2983	23.7677	31.1846	35.2229	38.8006 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-36.4473	-52.7205	-74.6876	-79.4719	-80.5850	-70.7082	-70.1945	-69.0176	-64.2354	-58.5441	-40.3527	-31.3601 (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)												

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(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												675.6618	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1107.7110	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												304.6752	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-728.3250	(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												1439.7231	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	675.6618	16.4900	111.4166	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1107.7110	16.4900	182.6615	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	304.6752	16.4900	50.2409	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-728.3250	16.4900	-120.1008	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-120.1008	(252)
Total energy cost			237.4103	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		1.0292	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	83.3161	
SAP rating (Section 12)		83	(258)
SAP band		B	

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

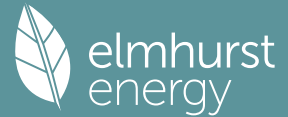
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	675.6618	0.1573	106.3132	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1107.7110	0.1460	161.7177	(264)
Space and water heating			268.0309	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	304.6752	0.1443	43.9741	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-728.3250	0.1357	-98.8153	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-98.8153	(269)
Total CO2, kg/year			224.2866	(272)
CO2 emissions per m2			5.9000	(273)
EI value			96.3807	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	38.0400	(1b) x 2.5000 (2b)	= 95.1000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	95.1000	(5)

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2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												2 * 10 =	20.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											20.0000 / (5) =	0.2103 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000	(17)
Infiltration rate												0.4603	(18)
Number of sides sheltered												2	(19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3913 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000	(22)
Adj infilt rate	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000	(22a)
Effective ac	0.4695	0.4402	0.4304	0.3815	0.3815	0.3521	0.3619	0.3424	0.3619	0.3913	0.4010	0.4304	(22b)
	0.6102	0.5969	0.5926	0.5728	0.5728	0.5620	0.5655	0.5586	0.5655	0.5765	0.5804	0.5926	(25)

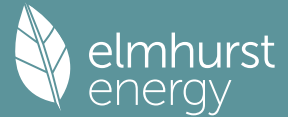
3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K						
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K						
Glazing			10.1200	1.1450	11.5878			(27)					
Solid Door			1.6200	1.2000	1.9440			(26)					
Rooflights			3.3600	1.5918	5.3483			(27a)					
Heatloss Floor			38.0400	0.1300	4.9452	110.0000	4184.4000	(28a)					
External Wall	27.5100	11.7400	15.7700	0.1800	2.8386	110.0000	1734.7000	(29a)					
Flat Roof	38.0400	3.3600	34.6800	0.1100	3.8148	9.0000	312.1200	(30)					
Total net area of external elements Aum(A, m2)			103.5900					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4787			(33)					
Main dwelling													
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000	(32)					
Internal Wall			20.7100			9.0000	186.3900	(32c)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9641.8100	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							253.4650	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				4.9400	0.0180	0.0889							
E3 Sill				2.5100	0.0160	0.0402							
E4 Jamb				28.4000	0.0110	0.3124							
E5 Ground floor (normal)				11.0100	0.0710	0.7817							
E14 Flat roof				11.0100	0.0400	0.4404							
E16 Corner (normal)				12.5000	0.0510	0.6375							
E17 Corner (inverted - internal area greater than external area)				2.5000	-0.1040	-0.2600							
P1 Party wall - Ground floor				18.4300	0.0440	0.8109							
P4 Party wall - Roof (insulation at ceiling level)				18.4300	0.0400	0.7372							
R1 Head of roof window				2.3900	0.2400	0.5736							
R2 Sill of roof window				3.0200	0.2400	0.7248							
R3 Jamb of roof window				8.4000	0.2400	2.0160							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9036	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	37.3823	(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	19.1505	18.7317	18.5981	17.9750	17.9750	17.6372	17.7468	17.5306	17.7468	18.0936	18.2152	18.5981	(38)
Average = Sum(39)m / 12 =	56.5329	56.1140	55.9804	55.3573	55.3573	55.0195	55.1291	54.9129	55.1291	55.4759	55.5975	55.9804	(39)
												55.5489	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.4861	1.4751	1.4716	1.4552	1.4552	1.4464	1.4492	1.4436	1.4492	1.4584	1.4616	1.4716	(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												
Hot water usage for mixer showers												
Hot water usage for baths	46.9429	46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630
Hot water usage for other uses	20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415
Average daily hot water use (litres/day)	28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093
												88.0281
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	95.7624	93.7186	91.2291	87.4424	84.3677	81.0620	79.7907	82.2694	84.8837	88.3542	92.1994	95.5139
Energy content (annual)	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss (or HIU loss):	22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327
Store volume												
a) If manufacturer declared loss factor is known (kWh/day):									100.0000			
Temperature factor from Table 2b									1.8000			
									0.7800			

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Enter (49) or (54) in (55)												1.4040 (55)
Total storage loss	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (56)
If cylinder contains dedicated solar storage	43.5240	39.3120	43.5240	42.1200	43.5240	42.1200	43.5240	43.5240	42.1200	43.5240	42.1200	43.5240 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	250.0458	222.3148	238.5974	214.9122	211.9568	164.3072	163.2863	168.6531	169.3021	218.2775	226.5629	247.9332 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												716.4066 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												716.4066
Solar input	-0.6846	-19.8834	-63.6098	-92.3732	-115.0785	-108.1438	-106.4953	-96.0101	-68.0891	-39.3322	-6.7066	-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	249.3613	202.4314	174.9876	122.5390	96.8783	56.1635	56.7910	72.6430	101.2130	178.9452	219.8564	247.9332 (64)
												Total per year (kWh/year) = Sum(64)m = 1779.7429 (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	94.3144	84.0125	90.5078	82.2721	81.6498	51.1516	50.6962	52.4806	52.8124	83.7515	86.1459	93.6120 (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	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.1299	38.3076	31.1539	23.5855	17.6304	14.8843	16.0831	20.9054	28.0591	35.6275	41.5826	44.3286 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869 (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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109 (71)
Water heating gains (Table 5)	126.7667	125.0186	121.6503	114.2667	109.7444	71.0439	68.1400	70.5384	73.3506	112.5692	119.6471	125.8226 (72)
Total internal gains	418.5748	413.8109	398.7366	374.0935	351.3827	295.4385	286.0522	291.4665	305.9846	365.4627	390.7291	411.1483 (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					1.6200	12.7054	0.6300	0.7000			0.7700			6.2903 (74)
East					8.5000	23.7288	0.6300	0.7000			0.7700			61.6406 (76)
North					3.3600	32.0000	0.6300	0.7000			1.0000			42.6747 (82)
Solar gains	110.6056	196.6486	332.5704	526.5145	633.1722	698.8203	655.1454	559.0578	419.2407	252.3878	140.1454			87.4143 (83)
Total gains	529.1804	610.4595	731.3070	900.6080	984.5548	994.2588	941.1976	850.5242	725.2253	617.8505	530.8745			498.5626 (84)

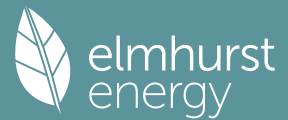
7. Mean internal temperature (heating season)

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	47.3756	47.7293	47.8432	48.3817	48.3817	48.6787	48.5820	48.7732	48.5820	48.2782	48.1727	47.8432
alpha	4.1584	4.1820	4.1895	4.2254	4.2254	4.2452	4.2388	4.2515	4.2388	4.2185	4.2115	4.1895
util living area	0.9523	0.9207	0.8315	0.6497	0.4616	0.3084	0.2106	0.2257	0.4471	0.7294	0.9075	0.9584 (86)
MIT	20.1361	20.3074	20.5902	20.8248	20.9060	20.9243	20.9267	20.9268	20.9141	20.7975	20.4606	20.1226 (87)
Th 2	19.6979	19.7062	19.7089	19.7212	19.7212	19.7280	19.7258	19.7301	19.7258	19.7189	19.7165	19.7089 (88)
util rest of house	0.9384	0.8995	0.7927	0.5923	0.3953	0.2391	0.1362	0.1440	0.3562	0.6585	0.8782	0.9457 (89)
MIT 2	18.9645	19.1313	19.3859	19.5840	19.6382	19.6543	19.6528	19.6574	19.6485	19.5704	19.2875	18.9618 (90)
Living area fraction	19.3597	19.5280	19.7921	20.0025	20.0658	20.0827	20.0825	20.0855	20.0754	19.9843	19.6832	19.3533 (91)
MIT	19.3597	19.5280	19.7921	20.0025	20.0658	20.0827	20.0825	20.0855	20.0754	19.9843	19.6832	19.3533 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3597	19.5280	19.7921	20.0025	20.0658	20.0827	20.0825	20.0855	20.0754	19.9843	19.6832	19.3533 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9340	0.8961	0.7955	0.6055	0.4135	0.2585	0.1571	0.1669	0.3816	0.6743	0.8773	0.9415 (94)
Ext temp.	494.2539	547.0149	581.7423	545.2973	407.0995	257.0193	147.8333	141.9189	276.7472	416.6268	465.7320	469.3817 (95)
Heat loss rate W	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)

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Space heating	811.7940	792.7761	710.5076	581.3897	413.2882	257.6378	147.8821	141.9774	279.8010	459.5769	643.9949	792.3081 (97)
Space heating requirement - total per year (kWh/year)	236.2498	165.1515	95.8014	25.9865	4.6043	0.0000	0.0000	0.0000	0.0000	31.9548	128.3493	240.2573 (98a)
Solar 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 (98b)
Solar heating contribution - total per year (kWh/year)	236.2498	165.1515	95.8014	25.9865	4.6043	0.0000	0.0000	0.0000	0.0000	31.9548	128.3493	240.2573 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												928.3550
Space heating per m2												24.4047 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	236.2498	165.1515	95.8014	25.9865	4.6043	0.0000	0.0000	0.0000	0.0000	31.9548	128.3493	240.2573 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	138.9705	97.1479	56.3538	15.2862	2.7084	0.0000	0.0000	0.0000	0.0000	18.7970	75.4996	141.3278 (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	249.3613	202.4314	174.9876	122.5390	96.8783	56.1635	56.7910	72.6430	101.2130	178.9452	219.8564	247.9332 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	146.6831	119.0773	102.9339	72.0818	56.9872	33.0373	33.4065	42.7312	59.5370	105.2619	129.3273	145.8431 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	37.7514	30.2856	27.2688	19.9783	15.4318	12.6079	14.0774	18.2983	23.7677	31.1846	35.2229	38.8006 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-41.6663	-54.3942	-75.9440	-81.5956	-81.1174	-71.8395	-71.2731	-71.0812	-67.3499	-62.1291	-45.8236	-34.9217 (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												546.0912 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												1046.9076 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												304.6752 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-759.1357 (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												1218.5382 (238)

10a. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	546.0912	27.6700	151.1034 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1046.9076	27.6700	289.6793 (247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	27.6700	22.1360 (249)
Energy for lighting	304.6752	27.6700	84.3036 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-759.1357	27.6700	-210.0529
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-210.0529 (252)
Total energy cost			337.1695 (255)

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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	546.0912	0.1581	86.3547 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1046.9076	0.1470	153.8791 (264)
Space and water heating			240.2338 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	304.6752	0.1443	43.9741 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-759.1357	0.1360	-103.2608
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-103.2608 (269)
Total CO2, kg/year			192.0440 (272)

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	546.0912	1.5854	865.7542 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1046.9076	1.5438	1616.1983 (278)
Space and water heating			2481.9525 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	304.6752	1.5338	467.3210 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-759.1357	1.5028	-1140.8359
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1140.8359 (283)
Total Primary energy kWh/year			1929.4616 (286)

ii. Be Lean

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Plot Reference	Be Lean			Issued on Date	02/09/2026
Assessment Reference	00001	Plot Type Ref			
Plot Address				SAP Version	10.2
SAP Rating	77 C	DER	7.96	TER	14.25
Environmental	95 A	% DER < TER			44.14
CO ₂ Emissions (t/year)	0.28	DFEE	42.90	TFEE	47.81
Compliance Check	See BREL	% DFEE < TFEE			10.26
% DPER < TPER	-10.16	DPER	83.78	TPER	76.05
Assessor Details	Miss Charlotte Russell			Assessor ID	DK97-0001
Client	Arch, Architectural Design Studio				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	38.0400 (1b)	2.5000 (2b)	95.1000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		95.1000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	95.1000 (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	0 * 10 = 0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2000	(18)
Number of sides sheltered	2	(19)

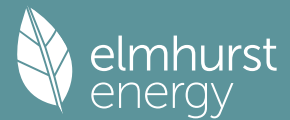
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)
Solid Door			1.6200	1.0000	1.6200		(26)
Rooflights			3.3600	1.1450	3.8473		(27a)
Heatloss Floor			38.0400	0.1200	4.5648	110.0000	4184.4000 (28a)
External Wall		11.7400	15.7700	0.1700	2.6809	110.0000	1734.7000 (29a)
Flat Roof	27.5100	3.3600	34.6800	0.1000	3.4680	9.0000	312.1200 (30)
Total net area of external elements Aum(A, m ²)			103.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7688		(33)
Main dwelling							
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000 (32)
Internal Wall			20.7100			9.0000	186.3900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							9641.8100 (34)
List of Thermal Bridges							253.4650 (35)
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)									4.9400		0.0180		0.0889
E3 Sill									2.5100		0.0160		0.0402
E4 Jamb									28.4000		0.0110		0.3124
E5 Ground floor (normal)									11.0100		0.0710		0.7817
E14 Flat roof									11.0100		0.0400		0.4404
E16 Corner (normal)									12.5000		0.0510		0.6375
E17 Corner (inverted - internal area greater than external area)									2.5000	-0.1040			-0.2600
P1 Party wall - Ground floor									18.4300		0.0440		0.8109
P4 Party wall - Roof (insulation at ceiling level)									18.4300		0.0400		0.7372
R1 Head of roof window									2.3900		0.2400		0.5736
R2 Sill of roof window									3.0200		0.2400		0.7248
R3 Jamb of roof window									8.4000		0.2400		2.0160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													6.9036 (36)
Point Thermal bridges												(36a) =	0.0000
Total fabric heat loss										(33) + (36) + (36a) =			34.6724 (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	(38)
Heat transfer coeff	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	
Average = Sum(39)m / 12 =	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	(39)
	50.3639												50.3639
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													1.3553 (42)
Hot water usage for mixer showers													
Hot water usage for baths	46.9429	46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630	(42a)
Hot water usage for other uses	20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415	(42b)
Average daily hot water use (litres/day)	28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093	(42c)
	28.5093												(43)
	88.0281												
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	95.7624	93.7186	91.2291	87.4424	84.3677	81.0620	79.7907	82.2694	84.8837	88.3542	92.1994	95.5139	(44)
Energy content (annual)	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1462.1279	
Water storage loss (or HIU loss):	22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327	(46)
Store volume													80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1000 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													0.8580 (55)
Total storage loss	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(56)
If cylinder contains dedicated solar storage	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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	233.1198	207.0268	221.6714	198.5322	195.0308	147.9272	146.3603	151.7271	152.9221	201.3515	210.1829	231.0072	(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	233.1198	207.0268	221.6714	198.5322	195.0308	147.9272	146.3603	151.7271	152.9221	201.3515	210.1829	231.0072	(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)
Heat gains from water heating, kWh/month	94.3144	84.0125	90.5078	82.2721	81.6498	51.1516	50.6962	52.4806	52.8124	83.7515	86.1459	93.6120	(65)

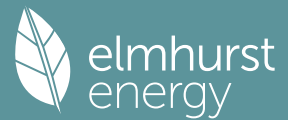
5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
(66)m	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9948	11.5419	9.3865	7.1062	5.3119	4.4846	4.8457	6.2987	8.4541	10.7344	12.5286	13.3560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	(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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	(71)
Water heating gains (Table 5)	126.7667	125.0186	121.6503	114.2667	109.7444	71.0439	68.1400	70.5384	73.3506	112.5692	119.6471	125.8226	(72)
Total internal gains	388.4397	387.0451	376.9692	357.6142	339.0642	285.0387	274.8148	276.8598	286.3795	340.5696	361.6751	380.1756	(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			1.6200	10.6334	0.6300	0.7000	0.7700	5.2645	(74)				
East			8.5000	19.6403	0.6300	0.7000	0.7700	51.0197	(76)				
North			3.3600	26.0000	0.6300	0.7000	1.0000	34.6732	(82)				

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Solar gains	90.9574	181.8797	309.4850	467.2146	586.8215	607.0553	575.3343	484.6456	365.0803	218.4201	114.1183	74.3502 (83)
Total gains	479.3971	568.9248	686.4542	824.8288	925.8857	892.0940	850.1492	761.5053	651.4598	558.9897	475.7934	454.5258 (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	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786
alpha	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452
util living area	0.9650	0.9307	0.8441	0.6789	0.4943	0.3591	0.2602	0.3033	0.5187	0.7920	0.9373	0.9716 (86)
MIT	20.1648	20.3616	20.6261	20.8317	20.9103	20.9278	20.9312	20.9305	20.9125	20.7676	20.4168	20.1120 (87)
Th 2	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221 (88)
util rest of house	0.9551	0.9128	0.8102	0.6275	0.4357	0.2940	0.1908	0.2261	0.4362	0.7366	0.9176	0.9634 (89)
MIT 2	19.0975	19.2833	19.5213	19.6882	19.7426	19.7526	19.7539	19.7537	19.7460	19.6472	19.3403	19.0468 (90)
Living area fraction	19.4575	19.6470	19.8940	20.0739	20.1364	20.1490	20.1510	20.1506	20.1394	20.0251	19.7034	19.4061 (91)
MIT	19.4575	19.6470	19.8940	20.0739	20.1364	20.1490	20.1510	20.1506	20.1394	20.0251	19.7034	19.4061 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4575	19.6470	19.8940	20.0739	20.1364	20.1490	20.1510	20.1506	20.1394	20.0251	19.7034	19.4061 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9514	0.9098	0.8124	0.6389	0.4516	0.3122	0.2102	0.2477	0.4590	0.7470	0.9153	0.9598 (94)
Useful gains	456.1103	517.5820	557.7001	527.0151	418.1341	278.4846	178.7228	188.6442	299.0046	417.5573	435.5023	436.2648 (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	763.3916	742.7168	674.5720	562.7595	424.8921	279.4679	178.8411	188.8957	304.1673	474.6850	634.7548	765.8370 (97)
Space heating kWh	228.6173	151.2906	86.9527	25.7360	5.0279	0.0000	0.0000	0.0000	0.0000	42.5030	143.4617	245.2017 (98a)
Space heating requirement - total per year (kWh/year)												928.7909
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	228.6173	151.2906	86.9527	25.7360	5.0279	0.0000	0.0000	0.0000	0.0000	42.5030	143.4617	245.2017 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												928.7909
Space heating per m2										(98c) / (4) =		24.4162 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	228.6173	151.2906	86.9527	25.7360	5.0279	0.0000	0.0000	0.0000	0.0000	42.5030	143.4617	245.2017 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	134.4807	88.9944	51.1487	15.1388	2.9576	0.0000	0.0000	0.0000	0.0000	25.0018	84.3893	144.2363 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	233.1198	207.0268	221.6714	198.5322	195.0308	147.9272	146.3603	151.7271	152.9221	201.3515	210.1829	231.0072 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	137.1293	121.7805	130.3949	116.7837	114.7240	87.0160	86.0943	89.2512	89.9542	118.4420	123.6370	135.8866 (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	2.1153	1.9106	2.1153	2.0471	2.1153	2.0471	2.1153	2.1153	2.0471	2.1153	2.0471	2.1153 (231)
Lighting	11.3743	9.1249	8.2159	6.0193	4.6495	3.7987	4.2414	5.5132	7.1611	9.3957	10.6125	11.6904 (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												546.3476 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												1351.0938 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:
(MEVDcentralised, Database: total watage = 4.5080, total flow = 21.0000, SFP = 0.2147)

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mechanical ventilation fans (SFP = 0.2147) 24.9061 (230a)
 Total electricity for the above, kWh/year 24.9061 (231)
 Electricity for lighting (calculated in Appendix L) 91.7969 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation 0.0000 (233)
 Wind generation 0.0000 (234)
 Hydro-electric generation (Appendix N) 0.0000 (235a)
 Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
 Appendix Q - special features
 Energy saved or generated -0.0000 (236)
 Energy used 0.0000 (237)
 Total delivered energy for all uses 2014.1444 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	546.3476	16.4900	90.0927 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1351.0938	16.4900	222.7954 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	24.9061	16.4900	4.1070 (249)
Energy for lighting	91.7969	16.4900	15.1373 (250)
Additional standing charges			0.0000 (251)
Total energy cost			332.1324 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
 Energy cost factor (ECF) 1.4399 (257)

$$[(255) \times (256)] / [(4) + 45.0] =$$

 SAP value 76.6595
 SAP rating (Section 12) 77 (258)
 SAP band C

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	546.3476	0.1578	86.1940 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1351.0938	0.1418	191.5268 (264)
Space and water heating			277.7208 (265)
Pumps, fans and electric keep-hot	24.9061	0.1387	3.4548 (267)
Energy for lighting	91.7969	0.1443	13.2491 (268)
Total CO2, kg/year			294.4247 (272)
CO2 emissions per m2			7.7400 (273)
EI value			95.2489
EI rating			95 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

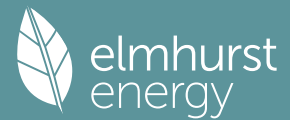
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	38.0400 (1b)	2.5000 (2b)	95.1000 (1b) - (3b)
Ground floor			95.1000 (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 95.1000 (5)
Dwelling volume			

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (21)

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Wind speed	Jan 4.8000	Feb 4.5000	Mar 4.4000	Apr 3.9000	May 3.9000	Jun 3.6000	Jul 3.7000	Aug 3.5000	Sep 3.7000	Oct 4.0000	Nov 4.1000	Dec 4.4000	(22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000	(22a)
Adj infilt rate	0.2040	0.1913	0.1870	0.1658	0.1658	0.1530	0.1573	0.1488	0.1573	0.1700	0.1742	0.1870	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

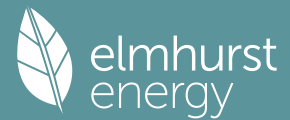
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			10.1200	1.1450	11.5878			(27)
Solid Door			1.6200	1.0000	1.6200			(26)
Rooflights			3.3600	1.1450	3.8473			(27a)
Heatloss Floor			38.0400	0.1200	4.5648	110.0000	4184.4000	(28a)
External Wall	27.5100	11.7400	15.7700	0.1700	2.6809	110.0000	1734.7000	(29a)
Flat Roof	38.0400	3.3600	34.6800	0.1000	3.4680	9.0000	312.1200	(30)
Total net area of external elements Aum(A, m2)			103.5900					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.7688		(33)
Main dwelling								
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000	(32)
Internal Wall			20.7100			9.0000	186.3900	(32c)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								9641.8100 (34)
List of Thermal Bridges								253.4650 (35)
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				4.9400	0.0180		0.0889	
E3 Sill				2.5100	0.0160		0.0402	
E4 Jamb				28.4000	0.0110		0.3124	
E5 Ground floor (normal)				11.0100	0.0710		0.7817	
E14 Flat roof				11.0100	0.0400		0.4404	
E16 Corner (normal)				12.5000	0.0510		0.6375	
E17 Corner (inverted - internal area greater than external area)				2.5000	-0.1040		-0.2600	
P1 Party wall - Ground floor				18.4300	0.0440		0.8109	
P4 Party wall - Roof (insulation at ceiling level)				18.4300	0.0400		0.7372	
R1 Head of roof window				2.3900	0.2400		0.5736	
R2 Sill of roof window				3.0200	0.2400		0.7248	
R3 Jamb of roof window				8.4000	0.2400		2.0160	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								6.9036 (36)
Point Thermal bridges								(36a) =
Total fabric heat loss								(33) + (36) + (36a) =
								34.6724 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 15.6915	Feb 15.6915	Mar 15.6915	Apr 15.6915	May 15.6915	Jun 15.6915	Jul 15.6915	Aug 15.6915	Sep 15.6915	Oct 15.6915	Nov 15.6915	Dec 15.6915	(38)
Heat transfer coeff	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	(39)
Average = Sum(39)m / 12 =													50.3639
HLP	Jan 1.3240	Feb 1.3240	Mar 1.3240	Apr 1.3240	May 1.3240	Jun 1.3240	Jul 1.3240	Aug 1.3240	Sep 1.3240	Oct 1.3240	Nov 1.3240	Dec 1.3240	(40)
HLP (average)													1.3240
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3553 (42)
Hot water usage for mixer showers													
46.9429	46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630	46.7630	(42a)
Hot water usage for baths													
20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415	20.2415	(42b)
Hot water usage for other uses													
28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093	28.5093	(42c)
Average daily hot water use (litres/day)													88.0281 (43)
Daily hot water use	Jan 95.7624	Feb 93.7186	Mar 91.2291	Apr 87.4424	May 84.3677	Jun 81.0620	Jul 79.7907	Aug 82.2694	Sep 84.8837	Oct 88.3542	Nov 92.1994	Dec 95.5139	(44)
Energy conte	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516	(45)
Energy content (annual)													Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m													1462.1279
22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327	22.4327	(46)
Water storage loss (or HIU loss):													
Store volume													80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1000 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													0.8580 (55)
Total storage loss													
26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	(56)
If cylinder contains dedicated solar storage													
26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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													
233.1198	207.0268	221.6714	198.5322	195.0308	147.9272	146.3603	151.7271	152.9221	201.3515	210.1829	231.0072	231.0072	(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													
233.1198	207.0268	221.6714	198.5322	195.0308	147.9272	146.3603	151.7271	152.9221	201.3515	210.1829	231.0072	231.0072	(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	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
94.3144	84.0125	90.5078	82.2721	81.6498	51.1516	50.6962	52.4806	52.8124	83.7515	86.1459	93.6120	93.6120	(65)

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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
	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9948	11.5419	9.3865	7.1062	5.3119	4.4846	4.8457	6.2987	8.4541	10.7344	12.5286	13.3560 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869 (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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109 (71)
Water heating gains (Table 5)	126.7667	125.0186	121.6503	114.2667	109.7444	71.0439	68.1400	70.5384	73.3506	112.5692	119.6471	125.8226 (72)
Total internal gains	388.4397	387.0451	376.9692	357.6142	339.0642	285.0387	274.8148	276.8598	286.3795	340.5696	361.6751	380.1756 (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	1.6200	12.7054	0.6300	0.7000	0.7700	6.2903 (74)						
East	8.5000	23.7288	0.6300	0.7000	0.7700	61.6406 (76)						
North	3.3600	32.0000	0.6300	0.7000	1.0000	42.6747 (82)						
Solar gains	110.6056	196.6486	332.5704	526.5145	633.1722	698.8203	655.1454	559.0578	419.2407	252.3878	140.1454	87.4143 (83)
Total gains	499.0453	583.6937	709.5396	884.1287	972.2364	983.8590	929.9603	835.9175	705.6202	592.9574	501.8205	467.5900 (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	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786
alpha	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452
util living area	0.9536	0.9175	0.8141	0.6185	0.4295	0.2860	0.1949	0.2107	0.4230	0.7120	0.9076	0.9612 (86)
MIT	20.2632	20.4249	20.6838	20.8664	20.9208	20.9305	20.9318	20.9317	20.9245	20.8383	20.5382	20.2299 (87)
Th 2	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221 (88)
util rest of house	0.9405	0.8965	0.7755	0.5651	0.3714	0.2262	0.1312	0.1399	0.3424	0.6445	0.8793	0.9496 (89)
MIT 2	19.1922	19.3424	19.5707	19.7130	19.7487	19.7536	19.7540	19.7540	19.7515	19.6995	19.4518	19.1613 (90)
Living area fraction	19.5534	19.7075	19.9461	20.1021	20.1440	20.1506	20.1512	20.1512	20.1471	20.0836	19.8182	19.5218 (92)
MIT	19.5534	19.7075	19.9461	20.1021	20.1440	20.1506	20.1512	20.1512	20.1471	20.0836	19.8182	19.5218 (93)
Temperature adjustment												0.0000
adjusted MIT	19.5534	19.7075	19.9461	20.1021	20.1440	20.1506	20.1512	20.1512	20.1471	20.0836	19.8182	19.5218 (93)
8. Space heating requirement												
Utilisation	0.9369	0.8942	0.7799	0.5782	0.3875	0.2429	0.1490	0.1597	0.3649	0.6604	0.8792	0.9461 (94)
Useful gains	467.5553	521.9346	553.3757	511.2003	376.6952	238.9647	138.5430	133.4990	257.4915	391.5978	441.2165	442.3792 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	732.9672	720.5834	646.9796	533.9610	379.9475	239.2578	138.5636	133.5259	259.2287	422.2316	590.1747	721.2998 (97)
Space heating kWh	197.4665	133.4920	69.6413	16.3877	2.4197	0.0000	0.0000	0.0000	0.0000	22.7915	107.2499	207.5170 (98a)
Space heating requirement - total per year (kWh/year)												756.9656
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	197.4665	133.4920	69.6413	16.3877	2.4197	0.0000	0.0000	0.0000	0.0000	22.7915	107.2499	207.5170 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												756.9656
Space heating per m2										(98c) / (4) =		19.8992 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	197.4665	133.4920	69.6413	16.3877	2.4197	0.0000	0.0000	0.0000	0.0000	22.7915	107.2499	207.5170 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	116.1568	78.5247	40.9655	9.6398	1.4233	0.0000	0.0000	0.0000	0.0000	13.4068	63.0882	122.0688 (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)

C 77
A 95

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N Solar water heating
U Solar photovoltaic panels
V2 Wind turbine

Recommended
Recommended
Not applicable

Recommended measures:
N Solar water heating
U Solar photovoltaic panels

SAP change
+ 3.2
+ 8.0

Cost change
-£ 91
-£ 200

CO2 change
-41 kg (14.9%)
-98 kg (41.4%)

Recommended measures
Solar water heating
Solar photovoltaic panels

Typical annual savings
£91
£200
£291

Energy efficiency
C 80
B 88

Environmental impact
A 96
A 97

Total Savings
3.67 kg/m²

Potential energy efficiency rating:
Potential environmental impact rating:

B 88
A 97

Fuel prices for cost data on this page from database revision number 597 TEST (31 Jul 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current £529	Potential £438	Saving £91
Electricity			
Space heating	£130	£152	-£22
Water heating	£374	£260	£113
Lighting	£25	£25	£0
Generated (PV)	-£0	-£200	£200
Total cost of fuels	£529	£238	£291
Total cost of uses	£529	£237	£291
Delivered energy	50 kWh/m²	23 kWh/m²	28 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.1 tonnes	0.1 tonnes
CO2 emissions per m²	7 kg/m²	4 kg/m²	4 kg/m²
Primary energy	77 kWh/m²	36 kWh/m²	41 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Main dwelling	38.0400 (1b)	2.5000 (2b)	95.1000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		95.1000 (5)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)

Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
Blower Door
Yes
4.0000 (17)
0.2000 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

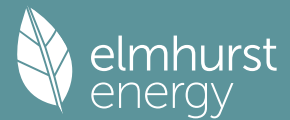
(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.1700 (21)

	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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)

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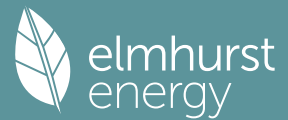
Solid Door				1.6200	1.0000	1.6200							(26)
Rooflights				3.3600	1.1450	3.8473							(27a)
Heatloss Floor				38.0400	0.1200	4.5648	110.0000			4184.4000			(28a)
External Wall	27.5100	11.7400		15.7700	0.1700	2.6809	110.0000			1734.7000			(29a)
Flat Roof	38.0400	3.3600		34.6800	0.1000	3.4680	9.0000			312.1200			(30)
Total net area of external elements Aum(A, m2)				103.5900									(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		27.7688							(33)
Main dwelling													
Party Wall				46.0600	0.0000	0.0000	70.0000			3224.2000			(32)
Internal Wall				20.7100			9.0000			186.3900			(32c)
Heat capacity Cm = Sum(A x k)													
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													(34)
List of Thermal Bridges													(35)
K1 Element						Length	Psi-value			Total			
E2 Other lintels (including other steel lintels)						4.9400	0.0180			0.0889			
E3 Sill						2.5100	0.0160			0.0402			
E4 Jamb						28.4000	0.0110			0.3124			
E5 Ground floor (normal)						11.0100	0.0710			0.7817			
E14 Flat roof						11.0100	0.0400			0.4404			
E16 Corner (normal)						12.5000	0.0510			0.6375			
E17 Corner (inverted - internal area greater than external area)						2.5000	-0.1040			-0.2600			
P1 Party wall - Ground floor						18.4300	0.0440			0.8109			
P4 Party wall - Roof (insulation at ceiling level)						18.4300	0.0400			0.7372			
R1 Head of roof window						2.3900	0.2400			0.5736			
R2 Sill of roof window						3.0200	0.2400			0.7248			
R3 Jamb of roof window						8.4000	0.2400			2.0160			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											6.9036		(36)
Point Thermal bridges											0.0000		
Total fabric heat loss											(33) + (36) + (36a) =	34.6724	(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	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	(38)
Average = Sum(39)m / 12 =	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	(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													1.3553 (42)
Hot water usage for mixer showers													
Hot water usage for baths	46.9429	46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630	(42a)
Hot water usage for other uses	20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415	(42b)
Average daily hot water use (litres/day)	28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093	(42c)
													88.0281 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	95.7624	93.7186	91.2291	87.4424	84.3677	81.0620	79.7907	82.2694	84.8837	88.3542	92.1994	95.5139	(44)
Energy content (annual)	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss (or HIU loss):	22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327	(46)
Store volume													80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1000 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													0.8580 (55)
Total storage loss													
If cylinder contains dedicated solar storage	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(56)
Primary loss	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980	(57)
Combi loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
Total heat required for water heating calculated for each month	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)
WWHRS	233.1198	207.0268	221.6714	198.5322	195.0308	147.9272	146.3603	151.7271	152.9221	201.3515	210.1829	231.0072	(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)
Aperture area of solar collector	-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)
Zero-loss collector efficiency													3.0000 (H1)
Collector linear heat loss coefficient													0.8000 (H2)
Collector 2nd order heat loss coefficient													1.8000 (H3)
Collector loop efficiency													0.0000 (H4)
Incidence angle modifier													0.9000 (H5)
Overshading factor													1.0000 (H6)
Overall heat loss coefficient of system													0.8000 (H8)
Heat loss coefficient of collector loop													6.5000 (H10)
Dedicated solar storage volume													3.9667 (H11)
Effective solar volume													75.0000 (H12)
Reference volume													75.0000 (H14)
Storage tank correction coefficient													225.0000 (H15)
Heat delivered to hot water													1.3161 (H16)
Heat delivered to space heating													598.1265 (H24)
Solar input													0.0000 (H29)
Solar input	-0.0000	-16.2462	-57.3432	-78.7633	-103.4503	-90.1049	-89.4800	-78.9708	-55.2062	-28.5616	-0.0000	-0.0000	598.1265
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	-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	0.0000 (63d)
Electric shower(s)													
Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =	233.1198	190.7807	164.3282	119.7689	91.5805	57.8223	56.8803	72.7563	97.7159	172.7898	210.1829	231.0072	(64)
Heat gains from water heating, kWh/month													1698.7330 (64)
	94.3144	84.0125	90.5078	82.2721	81.6498	51.1516	50.6962	52.4806	52.8124	83.7515	86.1459	93.6120	(65)

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

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9948	11.5419	9.3865	7.1062	5.3119	4.4846	4.8457	6.2987	8.4541	10.7344	12.5286	13.3560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	(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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	(71)
Water heating gains (Table 5)	126.7667	125.0186	121.6503	114.2667	109.7444	71.0439	68.1400	70.5384	73.3506	112.5692	119.6471	125.8226	(72)
Total internal gains	388.4397	387.0451	376.9692	357.6142	339.0642	285.0387	274.8148	276.8598	286.3795	340.5696	361.6751	380.1756	(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					1.6200	10.6334	0.6300	0.7000			0.7700	5.2645 (74)	
East					8.5000	19.6403	0.6300	0.7000			0.7700	51.0197 (76)	
North					3.3600	26.0000	0.6300	0.7000			1.0000	34.6732 (82)	
Solar gains	90.9574	181.8797	309.4850	467.2146	586.8215	607.0553	575.3343	484.6456	365.0803	218.4201	114.1183	74.3502	(83)
Total gains	479.3971	568.9248	686.4542	824.8288	925.8857	892.0940	850.1492	761.5053	651.4598	558.9897	475.7934	454.5258	(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	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	
alpha	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	
util living area	0.9650	0.9307	0.8441	0.6789	0.4943	0.3591	0.2602	0.3033	0.5187	0.7920	0.9373	0.9716	(86)
MIT	20.1648	20.3616	20.6261	20.8317	20.9103	20.9278	20.9312	20.9305	20.9125	20.7676	20.4168	20.1120	(87)
Th 2	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	(88)
util rest of house	0.9551	0.9128	0.8102	0.6275	0.4357	0.2940	0.1908	0.2261	0.4362	0.7366	0.9176	0.9634	(89)
MIT 2	19.0975	19.2833	19.5213	19.6882	19.7426	19.7526	19.7539	19.7537	19.7460	19.6472	19.3403	19.0468	(90)
Living area fraction	19.4575	19.6470	19.8940	20.0739	20.1364	20.1490	20.1510	20.1506	20.1394	20.0251	19.7034	19.4061	(91)
MIT	19.4575	19.6470	19.8940	20.0739	20.1364	20.1490	20.1510	20.1506	20.1394	20.0251	19.7034	19.4061	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4575	19.6470	19.8940	20.0739	20.1364	20.1490	20.1510	20.1506	20.1394	20.0251	19.7034	19.4061	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9514	0.9098	0.8124	0.6389	0.4516	0.3122	0.2102	0.2477	0.4590	0.7470	0.9153	0.9598	(94)
Useful gains	456.1103	517.5820	557.7001	527.0151	418.1341	278.4846	178.7228	188.6442	299.0046	417.5573	435.5023	436.2648	(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	763.3916	742.7168	674.5720	562.7595	424.8921	279.4679	178.8411	188.8957	304.1673	474.6850	634.7548	765.8370	(97)
Space heating kWh	228.6173	151.2906	86.9527	25.7360	5.0279	0.0000	0.0000	0.0000	0.0000	42.5030	143.4617	245.2017	(98a)
Space heating requirement - total per year (kWh/year)												928.7909	
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	228.6173	151.2906	86.9527	25.7360	5.0279	0.0000	0.0000	0.0000	0.0000	42.5030	143.4617	245.2017	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												928.7909	
Space heating per m2										(98c) / (4) =		24.4162	(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 %)													170.0000 (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	
	228.6173	151.2906	86.9527	25.7360	5.0279	0.0000	0.0000	0.0000	0.0000	42.5030	143.4617	245.2017	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	134.4807	88.9944	51.1487	15.1388	2.9576	0.0000	0.0000	0.0000	0.0000	25.0018	84.3893	144.2363	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	233.1198	190.7807	164.3282	119.7689	91.5805	57.8223	56.8803	72.7563	97.7159	172.7898	210.1829	231.0072	(64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(217)
Fuel for water heating, kWh/month													

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	137.1293	112.2239	96.6637	70.4523	53.8709	34.0131	33.4590	42.7978	57.4800	101.6411	123.6370	135.8866	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.9098	8.0476	8.9098	8.6224	8.9098	8.6224	8.9098	8.9098	8.6224	8.9098	8.6224	8.9098	(231)
Lighting	11.3743	9.1249	8.2159	6.0193	4.6495	3.7987	4.2414	5.5132	7.1611	9.3957	10.6125	11.6904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6566	-50.9965	-71.1736	-75.1691	-76.3463	-67.0276	-66.2400	-64.9725	-60.6980	-56.0884	-39.3067	-30.7685	(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												546.3476	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												999.2547	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.5080, total flow = 21.0000, SFP = 0.2147)													
mechanical ventilation fans (SFP = 0.2147)												24.9061	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												104.9061	(231)
Electricity for lighting (calculated in Appendix L)												91.7969	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-694.4438	(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												1047.8614	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	546.3476	16.4900	90.0927 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	999.2547	16.4900	164.7771 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	24.9061	16.4900	4.1070 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	91.7969	16.4900	15.1373 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-694.4438	16.4900	-114.5138
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-114.5138 (252)
Total energy cost			172.7924 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7491 (257)
SAP value		87.8571
SAP rating (Section 12)		88 (258)
SAP band		B

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	546.3476	0.1578	86.1940 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	999.2547	0.1466	146.5264 (264)
Space and water heating			232.7204 (265)
Pumps, fans and electric keep-hot	104.9061	0.1387	14.5518 (267)
Energy for lighting	91.7969	0.1443	13.2491 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-694.4438	0.1359	-94.3446
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-94.3446 (269)
Total CO2, kg/year			166.1768 (272)
CO2 emissions per m2			4.3700 (273)
EI value			97.3184
EI rating			97 (274)
EI band			A

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	38.0400 (1b)	x 2.5000 (2b)	= 95.1000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 95.1000 (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	0 * 10 = 0.0000 (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) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.2040	0.1913	0.1870	0.1658	0.1658	0.1530	0.1573	0.1488	0.1573	0.1700	0.1742	0.1870 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)
Solid Door			1.6200	1.0000	1.6200		(26)
Rooflights			3.3600	1.1450	3.8473		(27a)
Heatloss Floor			38.0400	0.1200	4.5648	110.0000	4184.4000 (28a)
External Wall	27.5100	11.7400	15.7700	0.1700	2.6809	110.0000	1734.7000 (29a)
Flat Roof	38.0400	3.3600	34.6800	0.1000	3.4680	9.0000	312.1200 (30)
Total net area of external elements Aum(A, m ²)			103.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7688		(33)
Main dwelling							
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000 (32)
Internal Wall			20.7100			9.0000	186.3900 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9641.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		253.4650 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	4.9400	0.0180	0.0889
E3 Sill	2.5100	0.0160	0.0402
E4 Jamb	28.4000	0.0110	0.3124
E5 Ground floor (normal)	11.0100	0.0710	0.7817
E14 Flat roof	11.0100	0.0400	0.4404
E16 Corner (normal)	12.5000	0.0510	0.6375
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.1040	-0.2600
P1 Party wall - Ground floor	18.4300	0.0440	0.8109
P4 Party wall - Roof (insulation at ceiling level)	18.4300	0.0400	0.7372
R1 Head of roof window	2.3900	0.2400	0.5736
R2 Sill of roof window	3.0200	0.2400	0.7248
R3 Jamb of roof window	8.4000	0.2400	2.0160

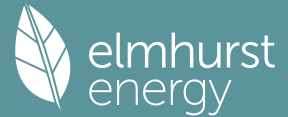
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.9036 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	34.6724 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915 (38)
Heat transfer coeff	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639 (39)
Average = Sum(39)m / 12 =												50.3639

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240 (40)
HLP (average)												1.3240
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3553 (42)
Hot water usage for mixer showers												46.7630 (42a)
Hot water usage for baths												20.2415 (42b)
Hot water usage for other uses												28.5093 (42c)
Average daily hot water use (litres/day)												88.0281 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	95.7624	93.7186	91.2291	87.4424	84.3677	81.0620	79.7907	82.2694	84.8837	88.3542	92.1994	95.5139 (44)
Distribution loss (46)m = 0.15 x (45)m	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516 (45)
Water storage loss (or HIU loss):	22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327 (46)
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1000 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												0.8580 (55)
Total storage loss	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980 (56)
If cylinder contains dedicated solar storage	26.5980	24.0240	26.5980	25.7400	26.5980	25.7400	26.5980	26.5980	25.7400	26.5980	25.7400	26.5980 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	233.1198	207.0268	221.6714	198.5322	195.0308	147.9272	146.3603	151.7271	152.9221	201.3515	210.1829	231.0072 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												696.9250 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												696.9250
Solar input	-0.8451	-19.8615	-62.9270	-90.6567	-112.2403	-103.6566	-101.8275	-92.5701	-66.4402	-39.0420	-6.8581	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	232.2748	187.1654	158.7444	107.8755	82.7904	44.2706	44.5329	59.1571	86.4819	162.3095	203.3248	231.0072 (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)
Heat gains from water heating, kWh/month	94.3144	84.0125	90.5078	82.2721	81.6498	51.1516	50.6962	52.4806	52.8124	83.7515	86.1459	93.6120 (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	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9948	11.5419	9.3865	7.1062	5.3119	4.4846	4.8457	6.2987	8.4541	10.7344	12.5286	13.3560 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869 (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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109 (71)
Water heating gains (Table 5)	126.7667	125.0186	121.6503	114.2667	109.7444	71.0439	68.1400	70.5384	73.3506	112.5692	119.6471	125.8226 (72)
Total internal gains	388.4397	387.0451	376.9692	357.6142	339.0642	285.0387	274.8148	276.8598	286.3795	340.5696	361.6751	380.1756 (73)

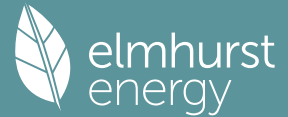
6. Solar gains

[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				1.6200	12.7054	0.6300		0.7000		0.7700	6.2903 (74)	
East				8.5000	23.7288	0.6300		0.7000		0.7700	61.6406 (76)	
North				3.3600	32.0000	0.6300		0.7000		1.0000	42.6747 (82)	
Solar gains	110.6056	196.6486	332.5704	526.5145	633.1722	698.8203	655.1454	559.0578	419.2407	252.3878	140.1454	87.4143 (83)
Total gains	499.0453	583.6937	709.5396	884.1287	972.2364	983.8590	929.9603	835.9175	705.6202	592.9574	501.8205	467.5900 (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	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786
alpha	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452
util living area	0.9536	0.9175	0.8141	0.6185	0.4295	0.2860	0.1949	0.2107	0.4230	0.7120	0.9076	0.9612 (86)

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MIT	20.2632	20.4249	20.6838	20.8664	20.9208	20.9305	20.9318	20.9317	20.9245	20.8383	20.5382	20.2299 (87)
Th 2	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221 (88)
util rest of house	0.9405	0.8965	0.7755	0.5651	0.3714	0.2262	0.1312	0.1399	0.3424	0.6445	0.8793	0.9496 (89)
MIT 2	19.1922	19.3424	19.5707	19.7130	19.7487	19.7536	19.7540	19.7540	19.7515	19.6995	19.4518	19.1613 (90)
Living area fraction									fLA = Living area / (4) =			0.3373 (91)
MIT	19.5534	19.7075	19.9461	20.1021	20.1440	20.1506	20.1512	20.1512	20.1471	20.0836	19.8182	19.5218 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5534	19.7075	19.9461	20.1021	20.1440	20.1506	20.1512	20.1512	20.1471	20.0836	19.8182	19.5218 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9369	0.8942	0.7799	0.5782	0.3875	0.2429	0.1490	0.1597	0.3649	0.6604	0.8792	0.9461	(94)
Useful gains	467.5553	521.9346	553.3757	511.2003	376.6952	238.9647	138.5430	133.4990	257.4915	391.5978	441.2165	442.3792	(95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	732.9672	720.5834	646.9796	533.9610	379.9475	239.2578	138.5636	133.5259	259.2287	422.2316	590.1747	721.2998	(97)
Space heating kWh	197.4665	133.4920	69.6413	16.3877	2.4197	0.0000	0.0000	0.0000	0.0000	22.7915	107.2499	207.5170	(98a)
Space heating requirement - total per year (kWh/year)												756.9656	
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	197.4665	133.4920	69.6413	16.3877	2.4197	0.0000	0.0000	0.0000	0.0000	22.7915	107.2499	207.5170	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												756.9656	
Space heating per m2											(98c) / (4) =	19.8992	(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 %)	170.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

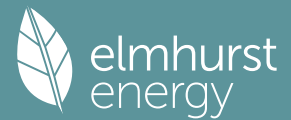
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	197.4665	133.4920	69.6413	16.3877	2.4197	0.0000	0.0000	0.0000	0.0000	22.7915	107.2499	207.5170	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	116.1568	78.5247	40.9655	9.6398	1.4233	0.0000	0.0000	0.0000	0.0000	13.4068	63.0882	122.0688	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	232.2748	187.1654	158.7444	107.8755	82.7904	44.2706	44.5329	59.1571	86.4819	162.3095	203.3248	231.0072 (64)	
Efficiency of water heater												170.0000 (216)	
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (217)	
Fuel for water heating, kWh/month	136.6322	110.0973	93.3791	63.4562	48.7002	26.0415	26.1958	34.7983	50.8717	95.4762	119.6028	135.8866 (219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	8.9098	8.0476	8.9098	8.6224	8.9098	8.6224	8.9098	8.6224	8.9098	8.6224	8.9098	8.9098 (231)	
Lighting	11.3743	9.1249	8.2159	6.0193	4.6495	3.7987	4.2414	5.5132	7.1611	9.3957	10.6125	11.6904 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-40.6758	-52.6141	-72.3896	-77.0913	-76.8266	-67.7295	-66.8939	-66.4499	-63.2571	-59.3279	-44.4801	-34.2096 (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												445.2739 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												170.0000	
Water heating fuel used												941.1379 (219)	
Space cooling fuel												0.0000 (221)	

Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.5080, total flow = 21.0000, SFP = 0.2147)												
mechanical ventilation fans (SFP = 0.2147)												24.9061 (230a)
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												104.9061 (231)
Electricity for lighting (calculated in Appendix L)												91.7969 (232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-721.9454 (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												861.1693 (238)

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10a. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	445.2739	27.6700	123.2073 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	941.1379	27.6700	260.4129 (247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (247a)
Pumps, fans and electric keep-hot	24.9061	27.6700	6.8915 (249)
Pump for solar water heating	80.0000	27.6700	22.1360 (249)
Energy for lighting	91.7969	27.6700	25.4002 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-721.9454	27.6700	-199.7623
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-199.7623 (252)
Total energy cost			238.2855 (255)

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	445.2739	0.1585	70.5784 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	941.1379	0.1477	139.0071 (264)
Space and water heating			209.5855 (265)
Pumps, fans and electric keep-hot	104.9061	0.1387	14.5518 (267)
Energy for lighting	91.7969	0.1443	13.2491 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-721.9454	0.1362	-98.3630
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-98.3630 (269)
Total CO2, kg/year			139.0234 (272)

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	445.2739	1.5867	706.5258 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	941.1379	1.5465	1455.4379 (278)
Space and water heating			2161.9637 (279)
Pumps, fans and electric keep-hot	104.9061	1.5128	158.7019 (281)
Energy for lighting	91.7969	1.5338	140.8012 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-721.9454	1.5036	-1085.5479
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1085.5479 (283)
Total Primary energy kWh/year			1375.9188 (286)

iii. Be Green

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Plot Reference	Be Green			Issued on Date	02/09/2026
Assessment Reference	1	Plot Type Ref			
Plot Address				SAP Version	10.2
SAP Rating	94 A	DER	1.80	TER	14.25
Environmental	99 A	% DER < TER			87.37
CO ₂ Emissions (t/year)	0.03	DFEE	42.90	TFEE	47.81
Compliance Check	See BREL	% DFEE < TFEE			10.26
% DPER < TPER	69.34	DPER	23.32	TPER	76.05
Assessor Details	Miss Charlotte Russell			Assessor ID	DK97-0001
Client	Arch, Architectural Design Studio				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	38.0400 (1b)	2.5000 (2b)	95.1000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		95.1000 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	95.1000 (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	0 * 10 = 0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2000	(18)
Number of sides sheltered	2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

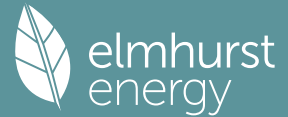
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)
Solid Door			1.6200	1.0000	1.6200		(26)
Rooflights			3.3600	1.1450	3.8473		(27a)
Heatloss Floor			38.0400	0.1200	4.5648	110.0000	4184.4000 (28a)
External Wall		11.7400	15.7700	0.1700	2.6809	110.0000	1734.7000 (29a)
Flat Roof	27.5100	3.3600	34.6800	0.1000	3.4680	9.0000	312.1200 (30)
Total net area of external elements Aum(A, m ²)			103.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7688		(33)
Main dwelling							
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000 (32)
Internal Wall			20.7100			9.0000	186.3900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							9641.8100 (34)
List of Thermal Bridges							253.4650 (35)
K1 Element				Length	Psi-value	Total	

6. Solar gains						
[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.6200	10.6334	0.6300	0.7000	0.7700	5.2645 (74)
East	8.5000	19.6403	0.6300	0.7000	0.7700	51.0197 (76)
North	3.3600	26.0000	0.6300	0.7000	1.0000	34.6732 (82)

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Solar gains	90.9574	181.8797	309.4850	467.2146	586.8215	607.0553	575.3343	484.6456	365.0803	218.4201	114.1183	74.3502 (83)
Total gains	462.2238	551.7515	669.2809	807.6554	908.7123	911.8940	869.9492	781.3053	671.2598	541.8163	458.6201	437.3524 (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	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786
alpha	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452
util living area	0.9692	0.9370	0.8535	0.6894	0.5028	0.3514	0.2543	0.2957	0.5048	0.8055	0.9442	0.9753 (86)
Living	20.1352	20.3363	20.6095	20.8253	20.9087	20.9282	20.9313	20.9306	20.9144	20.7549	20.3907	20.0815
Non living	18.8560	19.1009	19.4183	19.6444	19.7190	19.7331	19.7346	19.7344	19.7255	19.5857	19.1731	18.7894
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5576	20.3363	20.6095	20.8253	20.9087	20.9282	20.9313	20.9306	20.9144	20.7549	20.3907	20.2099 (87)
Th 2	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221 (88)
util rest of house	0.9603	0.9204	0.8207	0.6381	0.4435	0.2877	0.1865	0.2204	0.4240	0.7514	0.9263	0.9680 (89)
MIT 2	19.4369	19.1009	19.4183	19.6444	19.7190	19.7331	19.7346	19.7344	19.7255	19.5857	19.1731	18.9755 (90)
Living area fraction												0.3373 (91)
MIT	19.8149	19.5175	19.8200	20.0427	20.1203	20.1361	20.1382	20.1379	20.1265	19.9800	19.5838	19.3919 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8149	19.5175	19.8200	20.0427	20.1203	20.1361	20.1382	20.1379	20.1265	19.9800	19.5838	19.3919 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9603	0.9154	0.8206	0.6481	0.4588	0.3048	0.2047	0.2407	0.4454	0.7594	0.9219	0.9647 (94)
Useful gains	443.8623	505.0481	549.2274	523.4452	416.8935	277.9341	178.0930	188.0316	298.9540	411.4538	422.8170	421.9132 (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	781.3913	736.1968	670.8494	561.1888	424.0788	278.8220	178.1981	188.2533	303.5189	472.4151	628.7322	765.1214 (97)
Space heating kWh	251.1216	155.3319	90.4868	27.1754	5.3458	0.0000	0.0000	0.0000	0.0000	45.3552	148.2590	255.3469 (98a)
Space heating requirement - total per year (kWh/year)												978.4226
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	251.1216	155.3319	90.4868	27.1754	5.3458	0.0000	0.0000	0.0000	0.0000	45.3552	148.2590	255.3469 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												978.4226
Space heating per m2										(98c) / (4) =		25.7209 (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 %)												253.8389 (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	251.1216	155.3319	90.4868	27.1754	5.3458	0.0000	0.0000	0.0000	0.0000	45.3552	148.2590	255.3469 (98)
Space heating efficiency (main heating system 1)	253.8389	253.8389	253.8389	253.8389	253.8389	0.0000	0.0000	0.0000	0.0000	253.8389	253.8389	253.8389 (210)
Space heating fuel (main heating system)	98.9295	61.1931	35.6474	10.7057	2.1060	0.0000	0.0000	0.0000	0.0000	17.8677	58.4067	100.5941 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	193.3406	171.0972	181.8922	160.0362	155.2516	140.0072	138.1763	143.5431	145.0021	161.5723	171.6869	191.2280 (64)
Efficiency of water heater (217)m	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537 (216)
Fuel for water heating, kWh/month	98.5659	87.2261	92.7294	81.5872	79.1479	71.3763	70.4429	73.1789	73.9227	82.3702	87.5267	97.4889 (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	2.1153	1.9106	2.1153	2.0471	2.1153	2.0471	2.1153	2.1153	2.0471	2.1153	2.0471	2.1153 (231)
Lighting	11.3743	9.1249	8.2159	6.0193	4.6495	3.7987	4.2414	5.5132	7.1611	9.3957	10.6125	11.6904 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-23.8823	-42.9232	-78.3264	-105.0315	-124.4657	-119.6952	-117.4250	-104.9642	-82.2842	-55.2085	-28.8119	-19.4097 (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)	-0.8780	-3.5254	-13.0964	-33.2085	-58.3797	-64.6248	-62.5635	-44.5500	-23.6998	-7.6446	-1.6009	-0.5890 (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												385.4503 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												196.1537

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Water heating fuel used	995.5631 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 4.5080, total flow = 21.0000, SFP = 0.2147) mechanical ventilation fans (SFP = 0.2147)	24.9061 (230a)
Total electricity for the above, kWh/year	24.9061 (231)
Electricity for lighting (calculated in Appendix L)	91.7969 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1216.7885 (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	280.9279 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	385.4503	16.4900	63.5607 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	995.5631	16.4900	164.1684 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	24.9061	16.4900	4.1070 (249)
Energy for lighting	91.7969	16.4900	15.1373 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-902.4280	16.4900	-148.8104
PV Unit electricity exported	-314.3605	5.5900	-17.5728
Total			-166.3831 (252)
Total energy cost			80.5903 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	0.3494 (257)
SAP value	94.3366
SAP rating (Section 12)	94 (258)
SAP band	A

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	385.4503	0.1578	60.8256 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	995.5631	0.1409	140.2330 (264)
Space and water heating			201.0586 (265)
Pumps, fans and electric keep-hot	24.9061	0.1387	3.4548 (267)
Energy for lighting	91.7969	0.1443	13.2491 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-902.4280	0.1312	-118.4085
PV Unit electricity exported	-314.3605	0.1162	-36.5434
Total			-154.9519 (269)
Total CO2, kg/year			62.8107 (272)
CO2 emissions per m2			1.6500 (273)
EI value			98.9864
EI rating			99 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

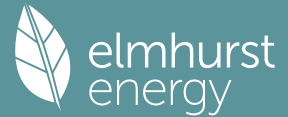
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	38.0400 (1b)	x 2.5000 (2b)	= 95.1000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	95.1000 (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)

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Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 0 * 10 = 0.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure Test Yes
Pressure Test Method Blower Door
Measured/design AP50 4.0000 (17)
Infiltration rate 0.2000 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000	(22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000	(22a)
Adj infilt rate	0.2040	0.1913	0.1870	0.1658	0.1658	0.1530	0.1573	0.1488	0.1573	0.1700	0.1742	0.1870	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)
Solid Door			1.6200	1.0000	1.6200		(26)
Rooflights			3.3600	1.1450	3.8473		(27a)
Heatloss Floor			38.0400	0.1200	4.5648	110.0000	4184.4000 (28a)
External Wall	27.5100	11.7400	15.7700	0.1700	2.6809	110.0000	1734.7000 (29a)
Flat Roof	38.0400	3.3600	34.6800	0.1000	3.4680	9.0000	312.1200 (30)
Total net area of external elements Aum(A, m2)			103.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					27.7688		(32)
Main dwelling							
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000 (32)
Internal Wall			20.7100			9.0000	186.3900 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9641.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 253.4650 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	4.9400	0.0180	0.0889
E2 Other lintels (including other steel lintels)	2.5100	0.0160	0.0402
E3 Sill	28.4000	0.0110	0.3124
E4 Jamb	11.0100	0.0710	0.7817
E5 Ground floor (normal)	11.0100	0.0400	0.4404
E14 Flat roof	12.5000	0.0510	0.6375
E16 Corner (normal)	2.5000	-0.1040	-0.2600
E17 Corner (inverted - internal area greater than external area)	18.4300	0.0440	0.8109
P1 Party wall - Ground floor	18.4300	0.0400	0.7372
P4 Party wall - Roof (insulation at ceiling level)	2.3900	0.2400	0.5736
R1 Head of roof window	3.0200	0.2400	0.7248
R2 Sill of roof window	8.4000	0.2400	2.0160
R3 Jamb of roof window			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.9036 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			34.6724 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	(38)
Heat transfer coeff	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	(39)
Average = Sum(39)m / 12 =													50.3639

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	(40)
HLP (average)													1.3240
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3553 (42)

Hot water usage for mixer showers 46.9429 46.2374 45.2094 43.2425 41.7910 40.1723 39.2522 40.2724 41.3908 43.1288 45.1379 46.7630 (42a)

Hot water usage for baths 20.3102 20.0086 19.5838 18.8006 18.2142 17.5639 17.2126 17.6344 18.0937 18.7895 19.5888 20.2415 (42b)

Hot water usage for other uses 28.5093 27.4726 26.4359 25.3992 24.3625 23.3258 23.3258 24.3625 25.3992 26.4359 27.4726 28.5093 (42c)

Average daily hot water use (litres/day) 88.0281 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	95.7624	93.7186	91.2291	87.4424	84.3677	81.0620	79.7907	82.2694	84.8837	88.3542	92.1994	95.5139	(44)
Energy conte	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516	(45)
Energy content (annual)													1462.1279
Distribution loss (46)m = 0.15 x (45)m													
22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327	(46)	
Water storage loss (or HIU loss):													
Store volume													80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5940 (55)
Total storage loss													
18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140	(56)	
If cylinder contains dedicated solar storage													
18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140	(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)

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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	193.3406	171.0972	181.8922	160.0362	155.2516	140.0072	138.1763	143.5431	145.0021	161.5723	171.6869	191.2280 (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	193.3406	171.0972	181.8922	160.0362	155.2516	140.0072	138.1763	143.5431	145.0021	161.5723	171.6869	191.2280 (64)
	Total per year (kWh/year) = Sum(64)m =											1952.8339 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	83.7695	74.4880	79.9629	72.0673	71.1049	65.4076	65.4274	67.2118	67.0684	73.2065	75.9411	83.0670 (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	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9948	11.5419	9.3865	7.1062	5.3119	4.4846	4.8457	6.2987	8.4541	10.7344	12.5286	13.3560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	(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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	(71)
Water heating gains (Table 5)	112.5934	110.8453	107.4770	100.0934	95.5710	90.8439	87.9400	90.3384	93.1506	98.3958	105.4738	111.6493	(72)
Total internal gains	371.2664	369.8718	359.7959	340.4408	321.8909	304.8387	294.6148	296.6598	306.1795	323.3962	344.5018	363.0023	(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					1.6200	12.7054	0.6300	0.7000				0.7700	6.2903 (74)
East					8.5000	23.7288	0.6300	0.7000				0.7700	61.6406 (76)
North					3.3600	32.0000	0.6300	0.7000				1.0000	42.6747 (82)
Solar gains	110.6056	196.6486	332.5704	526.5145	633.1722	698.8203	655.1454	559.0578	419.2407	252.3878	140.1454		87.4143 (83)
Total gains	481.8720	566.5204	692.3663	866.9553	955.0630	1003.6590	949.7603	855.7175	725.4202	575.7840	484.6472		450.4166 (84)

7. Mean internal temperature (heating season)

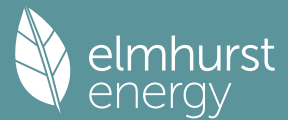
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786
alpha	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452
util living area	0.9588	0.9246	0.8242	0.6284	0.4368	0.2804	0.1908	0.2059	0.4120	0.7264	0.9165	0.9659 (86)
Living	20.2350	20.4011	20.6696	20.8622	20.9200	20.9307	20.9318	20.9317	20.9252	20.8303	20.5154	20.2008
Non living	18.9798	19.1789	19.4846	19.6785	19.7275	19.7343	19.7347	19.7347	19.7319	19.6581	19.3214	18.9387
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.6087	20.4011	20.6696	20.8622	20.9200	20.9307	20.9318	20.9317	20.9252	20.8303	20.5154	20.3126 (87)
Th 2	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221 (88)
util rest of house	0.9468	0.9049	0.7865	0.5747	0.3779	0.2217	0.1284	0.1367	0.3332	0.6593	0.8902	0.9555 (89)
MIT 2	19.4863	19.1789	19.4846	19.6785	19.7275	19.7343	19.7347	19.7347	19.7319	19.6581	19.3214	19.0979 (90)
Living area fraction												0.3373 (91)
MIT	19.8648	19.5911	19.8843	20.0777	20.1297	20.1378	20.1385	20.1385	20.1343	20.0535	19.7241	19.5076 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8648	19.5911	19.8843	20.0777	20.1297	20.1378	20.1385	20.1385	20.1343	20.0535	19.7241	19.5076 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9473	0.9004	0.7887	0.5867	0.3934	0.2375	0.1452	0.1553	0.3543	0.6733	0.8877	0.9522	(94)
Ext temp.	456.4883	510.1211	546.0612	508.6647	375.7685	238.3483	137.9021	132.8592	257.0498	387.7004	430.1976	428.8723	(95)
Heat loss rate W	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Space heating kWh	748.6521	714.7217	643.8662	532.7362	379.2240	238.6139	137.9204	132.8828	258.5858	420.7131	585.4340	720.5860	(97)
Space heating requirement - total per year (kWh/year)	217.3699	137.4916	72.7669	17.3315	2.5709	0.0000	0.0000	0.0000	0.0000	24.5615	111.7702	217.0350	(98a)
Solar heating kWh												800.8974	
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	217.3699	137.4916	72.7669	17.3315	2.5709	0.0000	0.0000	0.0000	0.0000	24.5615	111.7702	217.0350	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												800.8974	
Space heating per m2												21.0541	(99)

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

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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 %)												253.8389 (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	217.3699	137.4916	72.7669	17.3315	2.5709	0.0000	0.0000	0.0000	0.0000	24.5615	111.7702	217.0350 (98)
Space heating efficiency (main heating system 1)	253.8389	253.8389	253.8389	253.8389	253.8389	0.0000	0.0000	0.0000	0.0000	253.8389	253.8389	253.8389 (210)
Space heating fuel (main heating system)	85.6330	54.1649	28.6666	6.8278	1.0128	0.0000	0.0000	0.0000	0.0000	9.6760	44.0319	85.5011 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	193.3406	171.0972	181.8922	160.0362	155.2516	140.0072	138.1763	143.5431	145.0021	161.5723	171.6869	191.2280 (64)
Efficiency of water heater	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537 (216)
Fuel for water heating, kWh/month	98.5659	87.2261	92.7294	81.5872	79.1479	71.3763	70.4429	73.1789	73.9227	82.3702	87.5267	97.4889 (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	2.1153	1.9106	2.1153	2.0471	2.1153	2.0471	2.1153	2.1153	2.0471	2.1153	2.0471	2.1153 (231)
Lighting	11.3743	9.1249	8.2159	6.0193	4.6495	3.7987	4.2414	5.5132	7.1611	9.3957	10.6125	11.6904 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-29.1179	-46.4828	-83.4950	-114.4331	-130.5657	-129.8188	-126.7167	-115.4026	-91.6845	-62.7901	-35.2416	-22.9493 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-1.3564	-4.2666	-15.5463	-42.2389	-67.5168	-83.0708	-78.9844	-57.9196	-30.8883	-10.5386	-2.5440	-0.8587 (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												315.5141 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												196.1537
Water heating fuel used												995.5631 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.5080, total flow = 21.0000, SFP = 0.2147)												
mechanical ventilation fans (SFP = 0.2147)												24.9061 (230a)
Total electricity for the above, kWh/year												24.9061 (231)
Electricity for lighting (calculated in Appendix L)												91.7969 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1384.4275 (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												43.3527 (238)

10a. Fuel costs - using BEDF prices (597)												
						Fuel	Fuel price			Fuel cost		
						kWh/year	p/kWh			£/year		
Space heating - main system 1						315.5141	27.6700			87.3028 (240)		
Total CO2 associated with community systems										0.0000 (473)		
Water heating (other fuel)						995.5631	27.6700			275.4723 (247)		
Energy for instantaneous electric shower(s)						0.0000	27.6700			0.0000 (247a)		
Pumps, fans and electric keep-hot						24.9061	27.6700			6.8915 (249)		
Energy for lighting						91.7969	27.6700			25.4002 (250)		
Additional standing charges										0.0000 (251)		
Energy saving/generation technologies												
PV Unit electricity used in dwelling						-988.6980	27.6700			-273.5727		
PV Unit electricity exported						-395.7296	5.8100			-22.9919		
Total										-296.5646 (252)		
Total energy cost										98.5022 (255)		

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP												
						Energy	Emission factor			Emissions		
						kWh/year	kg CO2/kWh			kg CO2/year		
Space heating - main system 1						315.5141	0.1585			50.0221 (261)		
Total CO2 associated with community systems										0.0000 (373)		
Water heating (other fuel)						995.5631	0.1409			140.2330 (264)		
Space and water heating										190.2551 (265)		
Pumps, fans and electric keep-hot						24.9061	0.1387			3.4548 (267)		
Energy for lighting						91.7969	0.1443			13.2491 (268)		
Energy saving/generation technologies												
PV Unit electricity used in dwelling						-988.6980	0.1314			-129.9129		
PV Unit electricity exported						-395.7296	0.1159			-45.8791		
Total										-175.7919 (269)		
Total CO2, kg/year										31.1670 (272)		

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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	315.5141	1.5868	500.6688 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	995.5631	1.5208	1514.0919 (278)
Space and water heating			2014.7607 (279)
Pumps, fans and electric keep-hot	24.9061	1.5128	37.6779 (281)
Energy for lighting	91.7969	1.5338	140.8012 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-988.6980	1.4854	-1468.6553
PV Unit electricity exported	-395.7296	0.4249	-168.1515
Total			-1636.8068 (283)
Total Primary energy kWh/year			556.4330 (286)

SAP 10 EPC IMPROVEMENTS

1

Current energy efficiency rating: A 94
Current environmental impact rating: A 99

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO ₂ change
N Solar water heating	+ 2.4	-£ 62	-35 kg (112.1%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£62	0.92 kg/m ²	A 97	A 99
Total Savings	£62	0.92 kg/m ²		

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 597 TEST (31 Jul 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, South East England):

	Current	Potential	Saving
Electricity	£395	£316	£79
Space heating	£94	£116	-£22
Water heating	£275	£174	£102
Lighting	£25	£25	£0
Generated (PV)	-£297	-£280	-£17
Total cost of fuels	£98	£36	£62
Total cost of uses	£97	£35	£63
Delivered energy	1 kWh/m ²	-6 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	0.0 tonnes	-0.0 tonnes	0.0 tonnes
CO ₂ emissions per m ²	1 kg/m ²	-0 kg/m ²	1 kg/m ²
Primary energy	15 kWh/m ²	6 kWh/m ²	9 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

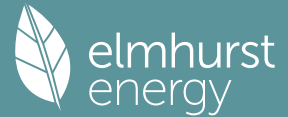
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	38.0400 (1b)	x 2.5000 (2b)	= 95.1000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	95.1000 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											
Pressure test	Air changes per hour											
Pressure Test Method	0.0000 / (5) = 0.0000 (8)											
Measured/design AP50	Yes											
Infiltration rate	Blower Door											
Number of sides sheltered	4.0000 (17)											
	0.2000 (18)											
	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (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)
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation	0.5000 (23a)											
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)											
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

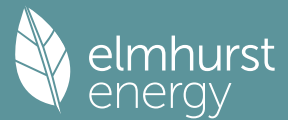
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)
Solid Door			1.6200	1.0000	1.6200		(26)
Rooflights			3.3600	1.1450	3.8473		(27a)
Heatloss Floor			38.0400	0.1200	4.5648	110.0000	4184.4000 (28a)
External Wall	27.5100	11.7400	15.7700	0.1700	2.6809	110.0000	1734.7000 (29a)
Flat Roof	38.0400	3.3600	34.6800	0.1000	3.4680	9.0000	312.1200 (30)
Total net area of external elements Aum(A, m2)			103.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					27.7688		(33)
Main dwelling							
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000 (32)
Internal Wall			20.7100			9.0000	186.3900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9641.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							253.4650 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				4.9400	0.0180	0.0889	
E3 Sill				2.5100	0.0160	0.0402	
E4 Jamb				28.4000	0.0110	0.3124	
E5 Ground floor (normal)				11.0100	0.0710	0.7817	
E14 Flat roof				11.0100	0.0400	0.4404	
E16 Corner (normal)				12.5000	0.0510	0.6375	
E17 Corner (inverted - internal area greater than external area)				2.5000	-0.1040	-0.2600	
P1 Party wall - Ground floor				18.4300	0.0400	0.8109	
P4 Party wall - Roof (insulation at ceiling level)				18.4300	0.0400	0.7372	
R1 Head of roof window				2.3900	0.2400	0.5736	
R2 Sill of roof window				3.0200	0.2400	0.7248	
R3 Jamb of roof window				8.4000	0.2400	2.0160	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9036 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 34.6724 (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	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915 (38)
Average = Sum(39)m / 12 =	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240 (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	1.3553 (42)											
Hot water usage for mixer showers	46.9429	46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630 (42a)
Hot water usage for baths	20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415 (42b)
Hot water usage for other uses	28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093 (42c)
Average daily hot water use (litres/day)												88.0281 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	95.7624	93.7186	91.2291	87.4424	84.3677	81.0620	79.7907	82.2694	84.8837	88.3542	92.1994	95.5139 (44)
Energy content (annual)	151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516 (45)
Distribution loss (46)m = 0.15 x (45)m	22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327 (46)
Water storage loss (or HIU loss):												
Store volume												80.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5940 (55)
Total storage loss	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (56)
If cylinder contains dedicated solar storage	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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	193.3406	171.0972	180.4964	153.2826	142.4572	127.4005	125.1494	131.4467	139.5992	160.1765	171.6869	191.2280 (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)

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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)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													565.1617 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													565.1617
Solar input	-0.0000	-16.3121	-55.5485	-73.8692	-92.8367	-84.9220	-83.9475	-75.2858	-54.1369	-28.3029	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	193.3406	154.7851	124.9479	79.4134	49.6206	42.4785	41.2019	56.1609	85.4623	131.8736	171.6869	191.2280	(64)
Total per year (kWh/year) = Sum(64)m =												1322.1998	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	83.7695	74.4880	78.8463	66.6644	60.8694	55.3222	55.0058	57.5346	62.7461	72.0899	75.9411	83.0670	(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	
	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9948	11.5419	9.3865	7.1062	5.3119	4.4846	4.8457	6.2987	8.4541	10.7344	12.5286	13.3560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	(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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	(71)
Water heating gains (Table 5)	112.5934	110.8453	105.9762	92.5894	81.8137	76.8364	73.9325	77.3315	87.1474	96.8950	105.4738	111.6493	(72)
Total internal gains	371.2664	369.8718	358.2951	332.9368	308.1335	290.8312	280.6074	283.6528	300.1763	321.8954	344.5018	363.0023	(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				1.6200	10.6334	0.6300	0.7000	0.7700	5.2645 (74)			
East				8.5000	19.6403	0.6300	0.7000	0.7700	51.0197 (76)			
North				3.3600	26.0000	0.6300	0.7000	1.0000	34.6732 (82)			
Solar gains	90.9574	181.8797	309.4850	467.2146	586.8215	607.0553	575.3343	484.6456	365.0803	218.4201	114.1183	74.3502 (83)
Total gains	462.2238	551.7515	667.7801	800.1514	894.9550	897.8865	855.9417	768.2984	665.2566	540.3155	458.6201	437.3524 (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	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	
alpha	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	
util living area	0.9692	0.9370	0.8543	0.6940	0.5098	0.3568	0.2585	0.3006	0.5090	0.8067	0.9442	0.9753	(86)
Living	20.1352	20.3363	20.6080	20.8223	20.9074	20.9279	20.9312	20.9305	20.9139	20.7537	20.3907	20.0815	
Non living	18.8560	19.1009	19.4166	19.6417	19.7181	19.7329	19.7346	19.7344	19.7252	19.5846	19.1731	18.7894	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.5576	20.3363	20.6080	20.8223	20.9074	20.9279	20.9312	20.9305	20.9139	20.7537	20.3907	20.2099	(87)
Th 2	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	(88)
util rest of house	0.9603	0.9204	0.8216	0.6427	0.4499	0.2921	0.1895	0.2241	0.4277	0.7527	0.9263	0.9680	(89)
MIT 2	19.4369	19.1009	19.4166	19.6417	19.7181	19.7329	19.7346	19.7344	19.7252	19.5846	19.1731	18.9755	(90)
Living area fraction													(91)
MIT	19.8149	19.5175	19.8185	20.0399	20.1192	20.1360	20.1382	20.1378	20.1261	19.9789	19.5838	19.3919	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8149	19.5175	19.8185	20.0399	20.1192	20.1360	20.1382	20.1378	20.1261	19.9789	19.5838	19.3919	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9603	0.9154	0.8215	0.6527	0.4653	0.3095	0.2081	0.2447	0.4491	0.7606	0.9219	0.9647	(94)
Useful gains	443.8623	505.0481	548.5755	522.2337	416.4222	277.8681	178.0843	188.0128	298.7771	410.9816	422.8170	421.9132	(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	781.3913	736.1968	670.7703	561.0485	424.0252	278.8142	178.1969	188.2508	303.4982	472.3587	628.7322	765.1214	(97)
Space heating kWh	251.1216	155.3319	90.9129	27.9466	5.6566	0.0000	0.0000	0.0000	0.0000	45.6646	148.2590	255.3469	(98a)
Space heating requirement - total per year (kWh/year)												980.2401	
Solar heating kWh													

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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	251.1216	155.3319	90.9129	27.9466	5.6566	0.0000	0.0000	0.0000	0.0000	45.6646	148.2590	255.3469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												980.2401	
Space heating per m2											(98c) / (4) =	25.7687	(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 %)													253.8389	(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	251.1216	155.3319	90.9129	27.9466	5.6566	0.0000	0.0000	0.0000	0.0000	45.6646	148.2590	255.3469	(98)	
Space heating efficiency (main heating system 1)	253.8389	253.8389	253.8389	253.8389	253.8389	0.0000	0.0000	0.0000	0.0000	253.8389	253.8389	253.8389	(210)	
Space heating fuel (main heating system)	98.9295	61.1931	35.8152	11.0096	2.2284	0.0000	0.0000	0.0000	0.0000	17.9896	58.4067	100.5941	(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	193.3406	154.7851	124.9479	79.4134	49.6206	42.4785	41.2019	56.1609	85.4623	131.8736	171.6869	191.2280	(64)	
Efficiency of water heater (217)m	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	(216)	
Fuel for water heating, kWh/month	98.5659	78.9101	63.6990	40.4853	25.2968	21.6557	21.0049	28.6311	43.5691	67.2297	87.5267	97.4889	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	8.9098	8.0476	8.9098	8.6224	8.9098	8.6224	8.9098	8.9098	8.6224	8.9098	8.6224	8.9098	(231)	
Lighting	11.3743	9.1249	8.2159	6.0193	4.6495	3.7987	4.2414	5.5132	7.1611	9.3957	10.6125	11.6904	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-23.8976	-42.8991	-77.3608	-100.4249	-112.4874	-106.3670	-104.4715	-96.7403	-79.5828	-54.9619	-28.8452	-19.4202	(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	-0.8627	-3.5495	-14.0619	-37.8151	-70.3580	-77.9530	-75.5170	-52.7739	-26.4012	-7.8913	-1.5676	-0.5786	(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													386.1663	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													196.1537	
Water heating fuel used													674.0631	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 4.5080, total flow = 21.0000, SFP = 0.2147)														
mechanical ventilation fans (SFP = 0.2147)													24.9061	(230a)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													104.9061	(231)
Electricity for lighting (calculated in Appendix L)													91.7969	(232)

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

PV generation													-1216.7885	(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													40.1439	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	386.1663	16.4900	63.6788	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	674.0631	16.4900	111.1530	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	24.9061	16.4900	4.1070	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	91.7969	16.4900	15.1373	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-847.4586	16.4900	-139.7459	
PV Unit electricity exported	-369.3299	5.5900	-20.6455	
Total			-160.3915	(252)
Total energy cost			46.8767	(255)

11a. SAP rating - Individual heating systems

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Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2032 (257)
SAP value		96.7058
SAP rating (Section 12)		97 (258)
SAP band		A

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	386.1663	0.1578	60.9275 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	674.0631	0.1473	99.2692 (264)
Space and water heating			160.1967 (265)
Pumps, fans and electric keep-hot	104.9061	0.1387	14.5518 (267)
Energy for lighting	91.7969	0.1443	13.2491 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-847.4586	0.1318	-111.7048
PV Unit electricity exported	-369.3299	0.1155	-42.6568
Total			-154.3616 (269)
Total CO ₂ , kg/year			33.6360 (272)
CO ₂ emissions per m ²			0.8800 (273)
EI value			99.4572
EI rating			99 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	38.0400 (1b)	x 2.5000 (2b)	= 95.1000 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 95.1000 (5)

2. Ventilation rate

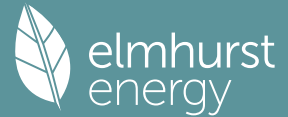
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (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)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.2040	0.1913	0.1870	0.1658	0.1658	0.1530	0.1573	0.1488	0.1573	0.1700	0.1742	0.1870 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Main dwelling							
Glazing			10.1200	1.1450	11.5878		(27)
Solid Door			1.6200	1.0000	1.6200		(26)
Rooflights			3.3600	1.1450	3.8473		(27a)
Heatloss Floor			38.0400	0.1200	4.5648	110.0000	4184.4000 (28a)
External Wall	27.5100	11.7400	15.7700	0.1700	2.6809	110.0000	1734.7000 (29a)
Flat Roof	38.0400	3.3600	34.6800	0.1000	3.4680	9.0000	312.1200 (30)
Total net area of external elements Aum(A, m ²)			103.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7688		(33)
Main dwelling							
Party Wall			46.0600	0.0000	0.0000	70.0000	3224.2000 (32)

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Internal Wall						20.7100				9.0000				186.3900 (32c)	
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =				9641.8100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K										253.4650 (35)					
List of Thermal Bridges															
K1 Element						Length				Psi-value				Total	
E2 Other lintels (including other steel lintels)						4.9400				0.0180				0.0889	
E3 Sill						2.5100				0.0160				0.0402	
E4 Jamb						28.4000				0.0110				0.3124	
E5 Ground floor (normal)						11.0100				0.0710				0.7817	
E14 Flat roof						11.0100				0.0400				0.4404	
E16 Corner (normal)						12.5000				0.0510				0.6375	
E17 Corner (inverted - internal area greater than external area)						2.5000				-0.1040				-0.2600	
P1 Party wall - Ground floor						18.4300				0.0440				0.8109	
P4 Party wall - Roof (insulation at ceiling level)						18.4300				0.0400				0.7372	
R1 Head of roof window						2.3900				0.2400				0.5736	
R2 Sill of roof window						3.0200				0.2400				0.7248	
R3 Jamb of roof window						8.4000				0.2400				2.0160	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)										(36a) =				6.9036 (36)	
Point Thermal bridges										(33) + (36) + (36a) =				0.0000	
Total fabric heat loss														34.6724 (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		15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	15.6915	(38)	
Average = Sum(39)m / 12 =		50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	50.3639	(39)	
		50.3639													
HLP		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)		1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	1.3240	(40)	
Days in mont		31	28	31	30	31	30	31	31	30	31	30	31		
		1.3240													
		31													

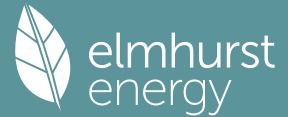
4. Water heating energy requirements (kWh/year)															

Assumed occupancy															
Hot water usage for mixer showers															
46.9429		46.2374	45.2094	43.2425	41.7910	40.1723	39.2522	40.2724	41.3908	43.1288	45.1379	46.7630	(42a)		
Hot water usage for baths		20.3102	20.0086	19.5838	18.8006	18.2142	17.5639	17.2126	17.6344	18.0937	18.7895	19.5888	20.2415	(42b)	
Hot water usage for other uses		28.5093	27.4726	26.4359	25.3992	24.3625	23.3258	23.3258	24.3625	25.3992	26.4359	27.4726	28.5093	(42c)	
Average daily hot water use (litres/day)		88.0281 (43)													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use		95.7624	93.7186	91.2291	87.4424	84.3677	81.0620	79.7907	82.2694	84.8837	88.3542	92.1994	95.5139	(44)	
Energy conte		151.6642	133.4540	140.2158	119.7042	113.5752	99.6752	96.4999	101.8667	104.6701	119.8959	131.3549	149.5516	(45)	
Energy content (annual)		Total = Sum(45)m = 1462.1279													
Distribution loss (46)m = 0.15 x (45)m		22.7496	20.0181	21.0324	17.9556	17.0363	14.9513	14.4750	15.2800	15.7005	17.9844	19.7032	22.4327	(46)	
Water storage loss (or HIU loss):															
Store volume		80.0000 (47)													
a) If manufacturer declared loss factor is known (kWh/day):		1.1000 (48)													
Temperature factor from Table 2b		0.5400 (49)													
Enter (49) or (54) in (55)		0.5940 (55)													
Total storage loss		18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140	(56)	
If cylinder contains dedicated solar storage		18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140	(57)	
Primary loss		23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	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		193.3406	171.0972	180.4964	153.2826	142.4572	127.4005	125.1494	131.4467	139.5992	160.1765	171.6869	191.2280	(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)	
Aperture area of solar collector		3.0000 (H1)													
Zero-loss collector efficiency		0.8000 (H2)													
Collector linear heat loss coefficient		1.8000 (H3)													
Collector 2nd order heat loss coefficient		0.0000 (H4)													
Collector loop efficiency		0.9000 (H5)													
Incidence angle modifier		1.0000 (H6)													
Overshading factor		0.8000 (H8)													
Overall heat loss coefficient of system		6.5000 (H10)													
Heat loss coefficient of collector loop		3.9667 (H11)													
Dedicated solar storage volume		75.0000 (H12)													
Effective solar volume		75.0000 (H14)													
Reference volume		225.0000 (H15)													
Storage tank correction coefficient		1.3161 (H16)													
Heat delivered to hot water		655.2854 (H24)													
Heat delivered to space heating		0.0000 (H29)													
Solar input		655.2854													
Solar input		-1.3353	-19.8023	-60.7835	-84.2756	-99.8982	-96.7635	-94.6090	-87.5057	-64.8572	-38.1214	-7.3337	-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		192.0053	151.2950	119.7130	69.0070	42.5590	30.6370	30.5404	43.9410	74.7420	122.0551	164.3532	191.2280	(64)	
		Total per year (kWh/year) = Sum(64)m = 1232.0760 (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		83.7695	74.4880	78.8463	66.6644	60.8694	55.3222	55.0058	57.5346	62.7461	72.0899	75.9411	83.0670	(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		81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	81.3164	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5		12.9948	11.5419	9.3865	7.1062	5.3119	4.4846	4.8457	6.2987	8.4541	10.7344	12.5286	13.3560	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		174.0858	175.8923	171.3401	161.6489	149.4155	137.9179	130.2368	128.4303	132.9825	142.6737	154.9071	166.4047	(68)	
		44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	44.4869	(69)	

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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)	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109	-54.2109 (71)
Water heating gains (Table 5)	112.5934	110.8453	105.9762	92.5894	81.8137	76.8364	73.9325	77.3315	87.1474	96.8950	105.4738	111.6493 (72)
Total internal gains	371.2664	369.8718	358.2951	332.9368	308.1335	290.8312	280.6074	283.6528	300.1763	321.8954	344.5018	363.0023 (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					1.6200	12.7054	0.6300	0.7000			0.7700	6.2903 (74)
East					8.5000	23.7288	0.6300	0.7000			0.7700	61.6406 (76)
North					3.3600	32.0000	0.6300	0.7000			1.0000	42.6747 (82)
Solar gains	110.6056	196.6486	332.5704	526.5145	633.1722	698.8203	655.1454	559.0578	419.2407	252.3878	140.1454	87.4143 (83)
Total gains	481.8720	566.5204	690.8655	859.4513	941.3057	989.6516	935.7528	842.7106	719.4170	574.2832	484.6472	450.4166 (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	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786	53.1786
alpha	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452	4.5452
util living area	0.9588	0.9246	0.8250	0.6327	0.4428	0.2843	0.1937	0.2090	0.4153	0.7276	0.9165	0.9659 (86)
Living	20.2350	20.4011	20.6683	20.8602	20.9193	20.9306	20.9318	20.9317	20.9250	20.8296	20.5154	20.2008
Non living	18.9798	19.1789	19.4833	19.6768	19.7270	19.7343	19.7347	19.7347	19.7318	19.6575	19.3214	18.9387
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.6087	20.4011	20.6683	20.8602	20.9193	20.9306	20.9318	20.9317	20.9250	20.8296	20.5154	20.3126 (87)
Th 2	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221	19.8221 (88)
util rest of house	0.9468	0.9049	0.7875	0.5790	0.3832	0.2248	0.1304	0.1388	0.3360	0.6606	0.8902	0.9555 (89)
MIT 2	19.4863	19.1789	19.4833	19.6768	19.7270	19.7343	19.7347	19.7347	19.7318	19.6575	19.3214	19.0979 (90)
Living area fraction	19.8648	19.5911	19.8830	20.0760	20.1292	20.1377	20.1385	20.1384	20.1342	20.0528	19.7241	19.5076 (91)
MIT	19.8648	19.5911	19.8830	20.0760	20.1292	20.1377	20.1385	20.1384	20.1342	20.0528	19.7241	19.5076 (92)
Temperature adjustment	19.8648	19.5911	19.8830	20.0760	20.1292	20.1377	20.1385	20.1384	20.1342	20.0528	19.7241	19.5076 (93)
adjusted MIT	19.8648	19.5911	19.8830	20.0760	20.1292	20.1377	20.1385	20.1384	20.1342	20.0528	19.7241	19.5076 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9473	0.9004	0.7896	0.5909	0.3990	0.2408	0.1474	0.1577	0.3572	0.6746	0.8877	0.9522 (94)
Useful gains	456.4883	510.1211	545.5085	507.8835	375.5420	238.3297	137.9006	132.8572	256.9909	387.4174	430.1976	428.8723 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	748.6521	714.7217	643.7998	532.6468	379.1981	238.6116	137.9201	132.8825	258.5787	420.6800	585.4340	720.5860 (97)
Space heating kWh	217.3699	137.4916	73.1287	17.8296	2.7201	0.0000	0.0000	0.0000	0.0000	24.7474	111.7702	217.0350 (98a)
Space heating requirement - total per year (kWh/year)												802.0925
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	217.3699	137.4916	73.1287	17.8296	2.7201	0.0000	0.0000	0.0000	0.0000	24.7474	111.7702	217.0350 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												802.0925
Space heating per m2										(98c) / (4) =		21.0855 (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 %)	253.8389 (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	217.3699	137.4916	73.1287	17.8296	2.7201	0.0000	0.0000	0.0000	0.0000	24.7474	111.7702	217.0350 (98)
Space heating efficiency (main heating system 1)	253.8389	253.8389	253.8389	253.8389	253.8389	0.0000	0.0000	0.0000	0.0000	253.8389	253.8389	253.8389 (210)
Space heating fuel (main heating system)	85.6330	54.1649	28.8091	7.0240	1.0716	0.0000	0.0000	0.0000	0.0000	9.7493	44.0319	85.5011 (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	192.0053	151.2950	119.7130	69.0070	42.5590	30.6370	30.5404	43.9410	74.7420	122.0551	164.3532	191.2280 (64)
Efficiency of water heater (217)m	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537	196.1537 (216)
Fuel for water heating, kWh/month	97.8851	77.1308	61.0302	35.1801	21.6968	15.6189	15.5696	22.4013	38.1038	62.2242	83.7880	97.4889 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.9098	8.0476	8.9098	8.6224	8.9098	8.6224	8.9098	8.9098	8.6224	8.9098	8.6224	8.9098 (231)

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Lighting	11.3743	9.1249	8.2159	6.0193	4.6495	3.7987	4.2414	5.5132	7.1611	9.3957	10.6125	11.6904	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-29.1398	-46.4284	-82.1728	-107.5234	-115.6169	-110.5645	-108.5125	-102.9937	-87.3337	-62.2160	-35.2657	-22.9651	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.3344	-4.3210	-16.8685	-49.1486	-82.4656	-102.3251	-97.1887	-70.3285	-35.2391	-11.1127	-2.5199	-0.8429	(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												315.9849	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												196.1537	
Water heating fuel used												628.1177	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 4.5080, total flow = 21.0000, SFP = 0.2147)													
mechanical ventilation fans (SFP = 0.2147)												24.9061	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												104.9061	(231)
Electricity for lighting (calculated in Appendix L)												91.7969	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1384.4275	(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												-243.6219	(238)

10a. Fuel costs - using BEDF prices (597)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	315.9849	27.6700	87.4330	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	628.1177	27.6700	173.8002	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	24.9061	27.6700	6.8915	(249)
Pump for solar water heating	80.0000	27.6700	22.1360	(249)
Energy for lighting	91.7969	27.6700	25.4002	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-910.7326	27.6700	-251.9997	
PV Unit electricity exported	-473.6949	5.8100	-27.5217	
Total			-279.5214	(252)
Total energy cost			36.1395	(255)

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	315.9849	0.1585	50.0896	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	628.1177	0.1485	93.2938	(264)
Space and water heating			143.3835	(265)
Pumps, fans and electric keep-hot	104.9061	0.1387	14.5518	(267)
Energy for lighting	91.7969	0.1443	13.2491	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-910.7326	0.1322	-120.4205	
PV Unit electricity exported	-473.6949	0.1151	-54.5224	
Total			-174.9430	(269)
Total CO2, kg/year			-3.7586	(272)

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	315.9849	1.5868	501.3901	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	628.1177	1.5495	973.2898	(278)
Space and water heating			1474.6799	(279)
Pumps, fans and electric keep-hot	104.9061	1.5128	158.7019	(281)
Energy for lighting	91.7969	1.5338	140.8012	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-910.7326	1.4886	-1355.6782	
PV Unit electricity exported	-473.6949	0.4218	-199.7867	
Total			-1555.4648	(283)
Total Primary energy kWh/year			218.7181	(286)

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
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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
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#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
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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	0
#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
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#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	0
	> 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	4
	>50%	7	
	>35%	4	

#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	1
	>65%	6	3	
	>50%	4	2	
	>35%	2	1	

#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	

#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	+50%	+100%	
	Single-aspect	4	3	
	Dual aspect	2	3	

TOTAL SCORE

4

= Sum of contributing factors:

10

minus

Sum of mitigating factors:

6

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)