



46 Priory Road, Hornsey

London N8 7EX

Energy Statement

Document Issue Record

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1.0 Executive Summary

EEABS (Elmstead Energy Assessments & Building Services) were instructed to produce an Energy Statement for the proposed development of a new low energy and sustainable dwelling located at 46 Priory Road, Hornsey, London N8 7EX.

This energy statement can be used as a supporting document to the planning application to demonstrate that the carbon emissions, and overall energy strategy of the proposed development will meet the requirements set out by Haringey Local Planning Policy, The London Plan, and Part L 2021 Building Regulations.

Relevant Planning Policies

The assessment of the development against policy targets has been carried out using the very latest Part L 2021 benchmarks. The Part L 2021 targets represent approximately a 30% reduction in carbon emissions in comparison to the Part L 2013 target.

To satisfy Haringey Local Plan Policy SP4 and London Plan Policy SI2 the development should achieve at least a minimum 35% improvement on Building Regulations from on-site measures. However, there is also a target benchmark of at least a 50% improvement on Building Regulations. New Developments must also achieve a reduction in carbon emissions of 20% from on-site renewables. The remaining carbon still emitted should be offset down to zero through a carbon offset payment believed to be set at £95 per tonne of CO₂ over a timeline of 30 years.

Haringey Development Management DPD Policy DM21 and London Plan Policy SI4 also state that developments should minimise the potential for overheating by assessing the cooling hierarchy of the development.

Assessment Methodology

This assessment has been carried out by following a Be Lean, Be Clean, and Be Green Energy Hierarchy.

To calculate the estimated carbon emissions of the development we have used Design SAP 10.2 software which is approved by Building Regulations. The baseline Target Emission Rate (TER) is calculated in accordance with Appendix R from the SAP 10.2 methodology.

SAP 10.2 is the very latest methodology which assesses a dwelling to the recently released (as of June 2022) Part L 2021 Building regulations. The Part L 2021 Building Regulations target represents an approximate 30% carbon reduction in comparison to the Part L 2013 standards.

The appraisals within this strategy are based on the Building Regulations Part L (2021) methodology and should not be understood as a predictive assessment of likely future energy requirements.

Be Lean

Savings have been made at the Be Lean stage thanks to increased performance of the building's constructions and air permeability.

Further savings have also been realised through the use of efficient lighting and mechanical ventilation systems.

Be Clean

Due to the small size of the development the possibility of connecting to an Area Wide Heat Network, other secondary heat source, or using a combined heat and power system (CHP) have all been deemed technically unfeasible.

Be Green

From brief assessment of the various renewable technologies available we concluded that an Air Source Heat Pump system providing the dwellings heating and hot water, along with PV Solar Panels would be the most feasible renewable technologies to install. The house will have a 2 kW solar panel system situated on the sloping east facing roof.

Overall Energy Assessment Results

The results below show total carbon emissions in tonnes CO2 for the dwelling as described throughout the energy hierarchy.

Table 1 - Summary of the Carbon Emission Results

	Carbon Dioxide Emissions (Tonnes CO2 per annum)	CO2 Savings (Tonnes CO2 per annum)	CO2 Savings (%)
Baseline	1.29	-	-
Be Lean	0.98	0.31	24%
Be Clean	0.98	0.00	0%
Be Green	0.29	0.69	54%
Cumulative Savings		1.00	78%
Carbon Shortfall to Offset	0.29		
Carbon Offset Contribution	£95 x 30 years x 0.29 tCO2 =	£826.50	

The results show that by implementing the energy strategy as described within this report the carbon emissions would 0.29 Tonnes CO2, this can be compared to 1.29 Tonnes CO2 for the Baseline.

This would be an overall improvement of 78%, therefore comfortably satisfying the requirements of Part L 2021 Building Regulations, Haringey Local Planning Policies, and the London Plan.

The final results show that the dwelling would still be emitting 0.29 tonnes of CO2 per annum. In order to off-set this remaining amount of carbon a cash in lieu contribution can be made to the local authority. The carbon is priced at £95 per tonne for a period of 30 years.

The total cash in lieu contribution required for the development would therefore be:

$$0.29 \text{ Tonnes} \times £95 \times 30 \text{ years} = £826.50$$



The proposed dwelling would also receive a very good EPC of at least a B rating, indicating that the units will have affordable running costs to the future occupants. It will also have an Environmental Impact Rating of an A, demonstrating that it is very environmentally friendly.

The cooling hierarchy indicated that there should be minimal overheating risk to the new dwelling. A full Building Regulations Part O Overheating assessment will be carried out at later design stages to prove this.

The SAP Calculation sheets and predicted EPCs for the development at each stage of the energy hierarchy can be found within the appendices.

Conclusion

This energy statement has shown that the proposed development of a new low energy and sustainable dwelling located at 46 Priory Road, Hornsey, London N8 7EX would comfortably satisfy the energy and sustainability requirements of Haringey Local Planning Policy, The London Plan, and Part L 2021 Building Regulations.

2.0 Introduction

EEABS (Elmstead Energy Assessments & Building Services) were instructed to produce an Energy Statement for the proposed development of a new low energy and sustainable dwelling located at 46 Priory Road, Hornsey, London N8 7EX.

This energy statement can be used as a supporting document to the planning application to demonstrate that the carbon emissions, and overall energy strategy of the proposed development will meet the requirements set out by Haringey Local Planning Policy, The London Plan, and Part L 2021 Building Regulations.

Proposed floor plans and elevations can be seen below. Please see the architectural submittal documents for full details.

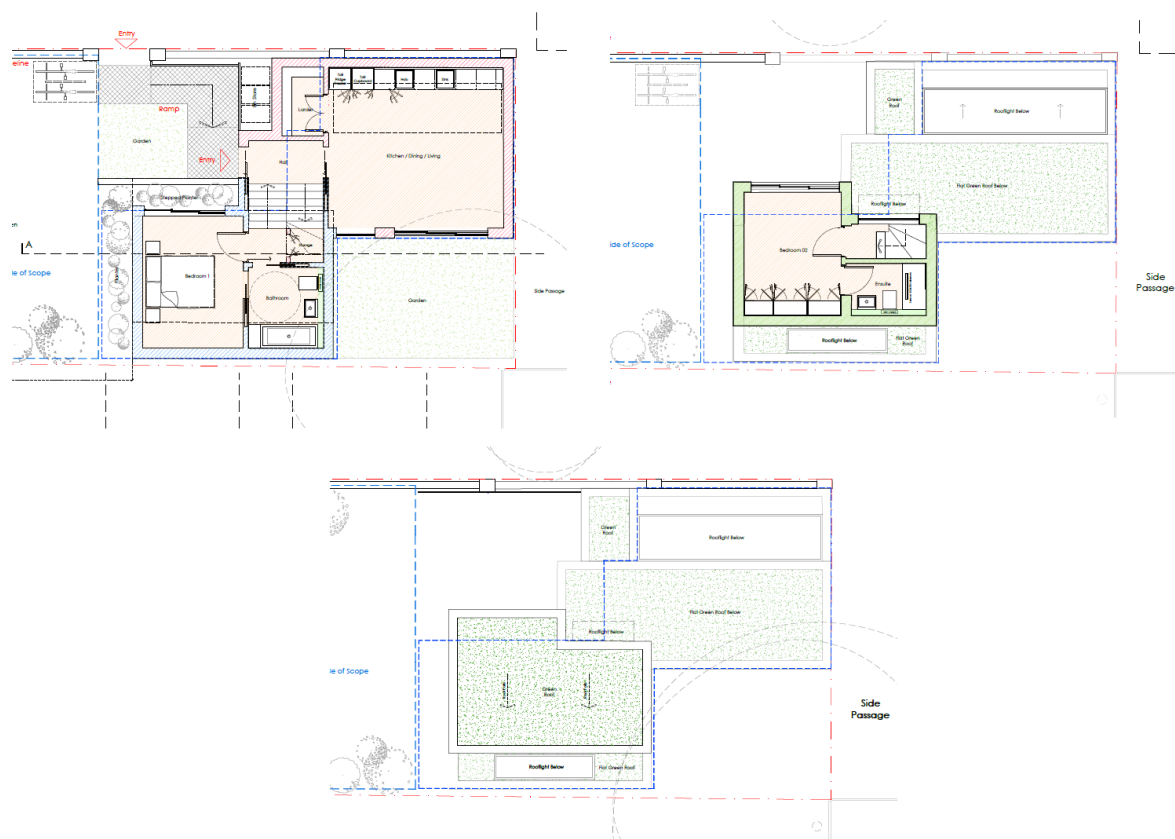


Figure 1 - Proposed Floor Plans

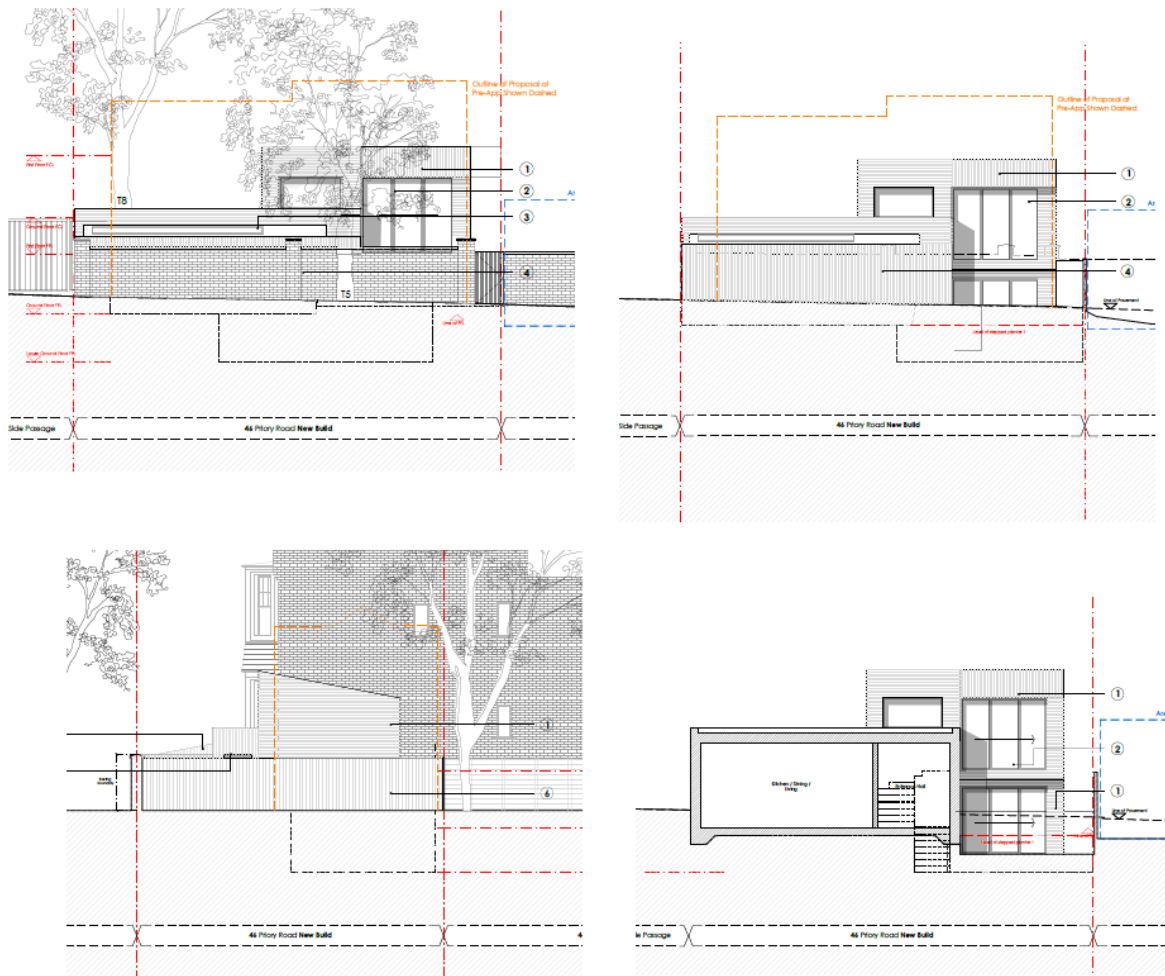


Figure 2 - Proposed Elevations

2.1 Planning Policy Context

Numerous policies that relate to the energy efficiency and carbon emissions of the development have been considered in preparation of this energy assessment.

2.1.1 National Planning Policy Framework

The National Planning Policy Framework encourages local planning authorities to adopt proactive strategies to mitigate and adapt to climate change.

They should plan for new development in ways which reduce greenhouse gas emissions; actively support energy efficiency improvements to existing buildings; and set local sustainability requirements which are consistent with the government's policies and standards.

2.1.2 Building Regulations Part L 2021

The assessment of the development against policy targets has been carried out using the very latest Part L 2021 benchmarks. The Part L 2021 targets represent approximately a 30% reduction in carbon emissions in comparison to the Part L 2013 target.

Part L 2021 is mandatory and requires that a dwelling does not exceed the CO₂ emission rate of that set by a Target Emission Rate (TER) calculated in accordance with Appendix R from the SAP 10.2 methodology.

It also requires that a dwelling does not exceed the Target Fabric Energy Efficiency (TFEE) and Target Primary Energy Rate (TPER).

2.1.3 Haringey Planning Policy

The Haringey Local Plan Strategic Policies 2013-2026 (Adopted March 2013) Policy SP4 states that all new developments should take measures to reduce energy use and carbon emissions during design, construction, and occupation. From 2016 onwards all new residential developments should also be zero carbon. New Developments must also achieve a reduction in carbon emissions of 20% from on-site renewables.

The Haringey Development management DPD (Adopted July 2017) Policy DM21 states that new development will be expected to consider and implement sustainable design, layout, and construction techniques. Proposals should apply the energy hierarchy to minimise energy use to meet the carbon reduction requirements and also apply the cooling hierarchy to reduce the potential for overheating.

2.1.4 The London Plan

The latest London Plan guidance on the preparation of Energy Assessments is from June 2022 and has been used to structure this energy statement. The guidance will be followed, and every effort will be made to ensure the most energy efficient and carbon minimal design possible.

Policy SI 2 of the London Plan requires development proposals to make the fullest contribution to minimising carbon dioxide emissions through on-site methods in accordance with the following energy hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

Residential developments should achieve at least a 10% improvement on Building Regulations from energy efficiency measures alone.

Overall, the development should achieve at least a minimum 35% improvement on Building Regulations from on-site measures. However, there is also a target benchmark of at least a 50% improvement on Building Regulations. The remaining carbon still emitted should be offset down to zero through a carbon offset payment believed to be set at £95 per tonne of CO₂ over a timeline of 30 years.

London Plan Policy SI4 also states that developments should minimise the potential for overheating by assessing the cooling hierarchy of the development.

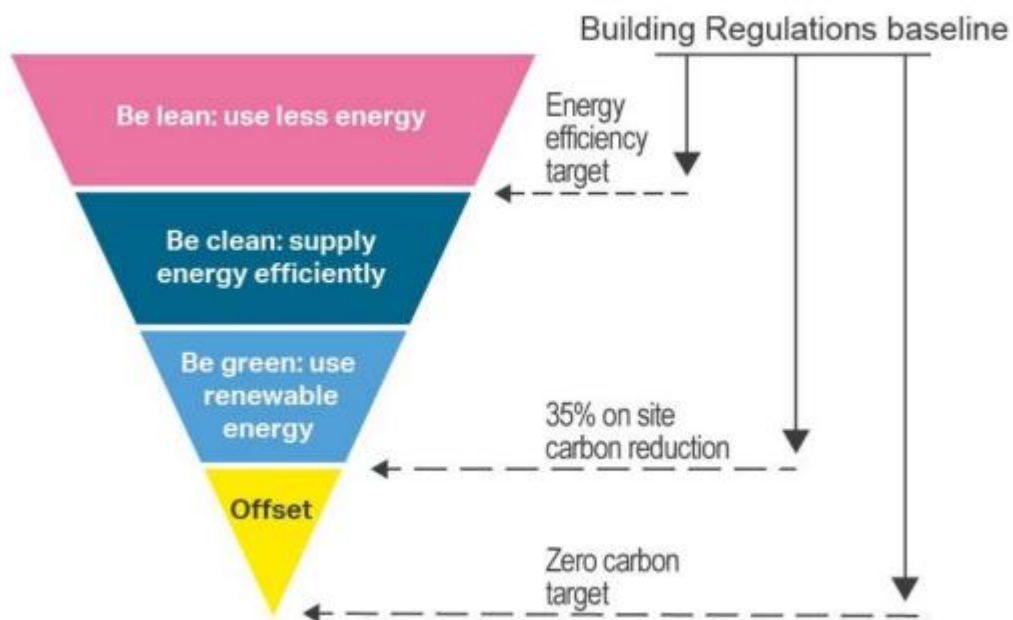


Figure 3 - London Plan Energy Hierarchy and Targets

3.0 Assessment Methodology

The energy strategy of the dwelling has been produced by following an Energy Hierarchy shown below taking a fabric first approach.

- Be Lean: use less energy
- Be Clean: supply energy efficiently
- Be Green: use renewable energy

The following methodology has been used to calculate the CO2 emissions for the development.

3.1 Part L 2021 SAP 10.2

To calculate the estimated carbon emissions of the development we have used Design SAP 10.2 software which is approved by Building Regulations. The baseline Target Emission Rate (TER) is calculated in accordance with Appendix R from the SAP 10.2 methodology.

SAP 10.2 is the very latest methodology which assesses a dwelling to the recently released (as of June 2022) Part L 2021 Building regulations. The Part L 2021 Building Regulations target represents an approximate 30% carbon reduction in comparison to the Part L 2013 standards.

3.2 Limitations

The appraisals within this strategy are based on the Building Regulations Part L (2021) calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise.

Occupants may operate their systems differently, and/or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements once the development is in operation.

4.0 Energy Assessment

The following sections describe how each stage of the Energy Hierarchy have been modelled and how their associated Carbon Emissions have been calculated.

4.1 Baseline Target

The baseline Target Emission Rate (TER) is calculated in accordance with Appendix R from the SAP 10.2 methodology. This Baseline CO₂ emission rate is then used as the basis for the target CO₂ reductions required throughout the Energy Hierarchy.

Table 2 - Baseline Carbon Emission Results

Unit	Area (m ²)	CO ₂ Emission Rate (kgCO ₂ /m ²)	Total CO ₂ Emissions (Tonnes of CO ₂)
New Dwelling - Baseline	70.34	18.38	1.29

The results show that the total Target CO₂ emissions for the development is estimated to be 1.29 Tonnes of CO₂ per annum.

This is the baseline that should be bettered by at least 10% under the Be Lean stage and then by 35-50% overall to meet the London Plan Requirements.

4.2 Be Lean

The following section describes the passive design and energy efficiency measures that have been considered and implemented within the proposed development.

4.2.1 Passive Design Measures

Passive design measures are those which reduce the initial energy demand of the building through passive means, for example wall insulation once installed requires no other means of operation and its performance is also unlikely to deteriorate.

Where possible the development has taken a fabric first approach to reducing the initial energy demand by the following methods:

Glazing Performance

Windows and glazed doors are to be highly efficient double glazing and will have a low U-value of 1.20 W/m².K, helping to reduce the amount of heat loss through the glazing.

Thermal Envelope

The inclusion of high levels of thermal insulation not only helps to reduce the buildings overall energy demand and therefore carbon emissions, but it also plays a vital role in securing the occupant's thermal comfort. It also helps to reduce the buildings peak heating and cooling loads required meaning that smaller plant equipment can be sized, helping to further improve not only carbon emissions but also the cost of the development.

The proposed walls, floor, and roof will provide significant savings over the Part L limiting fabric parameters.

Thermal Bridging

Thermal bridges are junctions between parts of the build through which heat can escape, for example the junction where a roof and wall construction meet.

We have assumed that the dwelling will achieve a total Thermal bridging Y-Value of 0.05 W/m².K. These will need to be provided or calculated in detail at later design stages once specific construction details and materials are determined.

Air Permeability

The air permeability of the development is a measure of how much volume of air can penetrate through its fabric. Therefore, a well built, highly sealed building would result in less unwanted heat loss, and therefore provide a more efficient building.

Part L Building Regulations have a maximum limit of 8 m³/h.m² that must be achieved, the proposed dwelling will target a value of 5 m³/h.m².

Summary of Passive Design Measures

The table below shows a summary of the passive design measures included for within the development and how they compare against the Part L requirements.

Table 3 - Summary Table of Passive Design Measures

Parameter	Part L Default Values	Development Proposal	% Improvement
U-Values			
Walls	0.26 W/m ² .K	0.18 W/m ² .K	31%
Floors	0.18 W/m ² .K	0.13 W/m ² .K	28%
Roofs	0.16 W/m ² .K	0.11 W/m ² .K	31%
Glazing	1.60 W/m ² .K	1.20 W/m ² .K	25%
Roof Lights	2.20 W/m ² .K	1.20 W/m ² .K	45%
Air Permeability	8.00 m ³ /h.m ²	5.00 m ³ /h.m ²	38%

The summary of passive measures shows that the proposed development will be a considerable improvement over the Part L limiting fabric parameters.

4.2.2 Energy Efficiency Measures

Energy efficiency measures are those which seek to supply the remaining demand for energy, after the initial demand has been lowered through passive means, in the most efficient way.

The following energy efficiency measures have been incorporated within the proposed development:

Heating and Hot Water

Under the Be Lean Stage of the assessment the dwellings heating and hot water is assumed to be provided by a gas fired boiler with a seasonal efficiency of 89.5%. This is to allow only the passive fabric and active energy savings measures to be assessed.

(The actual dwelling will have an electric air source heat pump system providing the heating and hot water requirements, this will be discussed under the Be Green Stage of the energy hierarchy)

Lighting

The lighting for the development will consist of low energy LED lighting throughout with a minimum efficacy of at least 100 lumens/watt. Better than the Part L requirement of only 75 lumens/watt.

Ventilation

A whole house mechanical ventilation system that has an assumed specific fan power of 1.02 W/l/s and a heat recovery efficiency of 93% has been included within the proposed design.

4.2.3 Regulated and Unregulated Energy Sources

Regulated energy sources are those that fall under the Building Regulations such as Space Heating, Hot Water, Space Cooling, Lighting and Auxiliary Loads (Pumps, Fans, and Controls). Unregulated energy sources such as small power, are not a part of the Part L Assessment however every effort should be made in order to reduce the consumption from unregulated sources.

To reduce the demand from unregulated sources the following is recommended:

- Any White Goods installed should be at least A/A+ rated.
- Occupants should be encouraged to turn TVs, computers etc. off at night when not in use.

4.2.4 Be Lean Stage Results

The table below shows the carbon emission results for the proposed dwelling under the Be Lean stage of the assessment.

Table 4 - Be Lean Stage Carbon Emission Results

Unit	Area (m ²)	CO ₂ Emission Rate (kgCO ₂ /m ²)	Total CO ₂ Emissions (Tonnes of CO ₂)
New Dwelling - Be Lean	70.34	13.99	0.98

The results show that the total Target CO₂ emissions for the development under the Be Lean stage are estimated to be 0.98 Tonnes of CO₂ per annum. In comparison to the Baseline emissions of 1.29 Tonnes of CO₂ per annum, this is a 24% improvement.

The London Plan requirement of at least a 10% improvement over the baseline from the Be Lean Stage alone has therefore comfortably been satisfied.

4.3 Be Clean

The following sections discuss the infrastructure and clean energy supply measures that have been considered for the Development to further reduce regulated CO₂ emissions.

4.3.1 Heating Hierarchy

Due to the small size of the development the possibility of connecting to an Area Wide Heat Network, other secondary heat source, or using a combined heat and power system (CHP) have all been deemed technically unfeasible.

Better results can be more easily achieved through the use of renewable technologies.

4.4 Be Green

The following sections discuss the low carbon and renewable technologies that have been considered for the development.

4.4.1 Assessment of Renewable / Low Carbon Technologies

The table below provides a brief analysis of the different renewables and low carbon technologies considered for the site and comments on their overall feasibility.

Table 5 - Low Carbon and Renewable Technologies Analysis

Low Carbon or Renewable Technology	Comments	Feasible
Air Source Heat Pumps	ASHPs can be used to provide both heating and hot water. With a high Seasonal Coefficient of Performance (SCOP) the benefit of a providing heating from an ASHP could outweigh the use of a gas boiler. ASHP also have a greater air quality than that of boilers as no harmful emissions are produce don site.	Yes
Ground Source Heat Pumps	Ground Source Heat Pumps are usually more efficient than ASHP as the temperature of the ground is more stable throughout the year. However, the installation of Ground Source is complex, requiring a lot of free ground area, and would not be economically or practically feasible for this project.	No
Photovoltaic Solar Panels	PV panels are a simple to install technology that can produce green electricity with very little ongoing maintenance. The available roof space that would not suffer from shading is limited, but PV Panels should be utilised where possible.	Yes
Solar Hot Water Panels	Solar Hot Water Panels would also need to be installed on the roof of the development. The amount of free space is limited and would be better utilized by Solar PV panels.	No
Biomass Boiler	A biomass boiler uses wood chips/pellets and would need a constant supply. A large storage area would be required to store the fuel on the site. There are also concerns with local air quality.	No
Wind Turbines	Large wind turbines would be required to produce any significant electrical savings. As the development is close to existing buildings the installation of any such turbine would be unfeasible.	No

From brief assessment of the various renewable technologies available we can see that Air Source Heat Pump systems and PV Panels would be the most feasible renewable technologies to install.

4.4.2 Air Source heat Pump

For the proposed dwelling we have assumed that a Mitsubishi Ecodan 8.5 kW heat pump would be installed to serve the heating and hot water requirements. This heat pump has a seasonal efficiency of 272% (SCOP 2.72) within the SAP calculation database.

(This heat pump has only been selected as an example at planning stage, the actual heat pump installed may change at later design stages, however a similar or better efficiency will be targeted)

4.4.3 Solar Photovoltaic Panels

For the dwelling we have assumed that it would have 4 No. 500 Watt panels installed on its highest east facing sloped roof. This would be a 2 kW peak system and is estimated to produce 922 kWh of electricity per year.

This is believed to be the only viable roof space for the panels, as the other roof is lower down and would receive considerable shading. The proposed solar panels should also be able to be incorporated onto the green roof using a suitable mounting system.

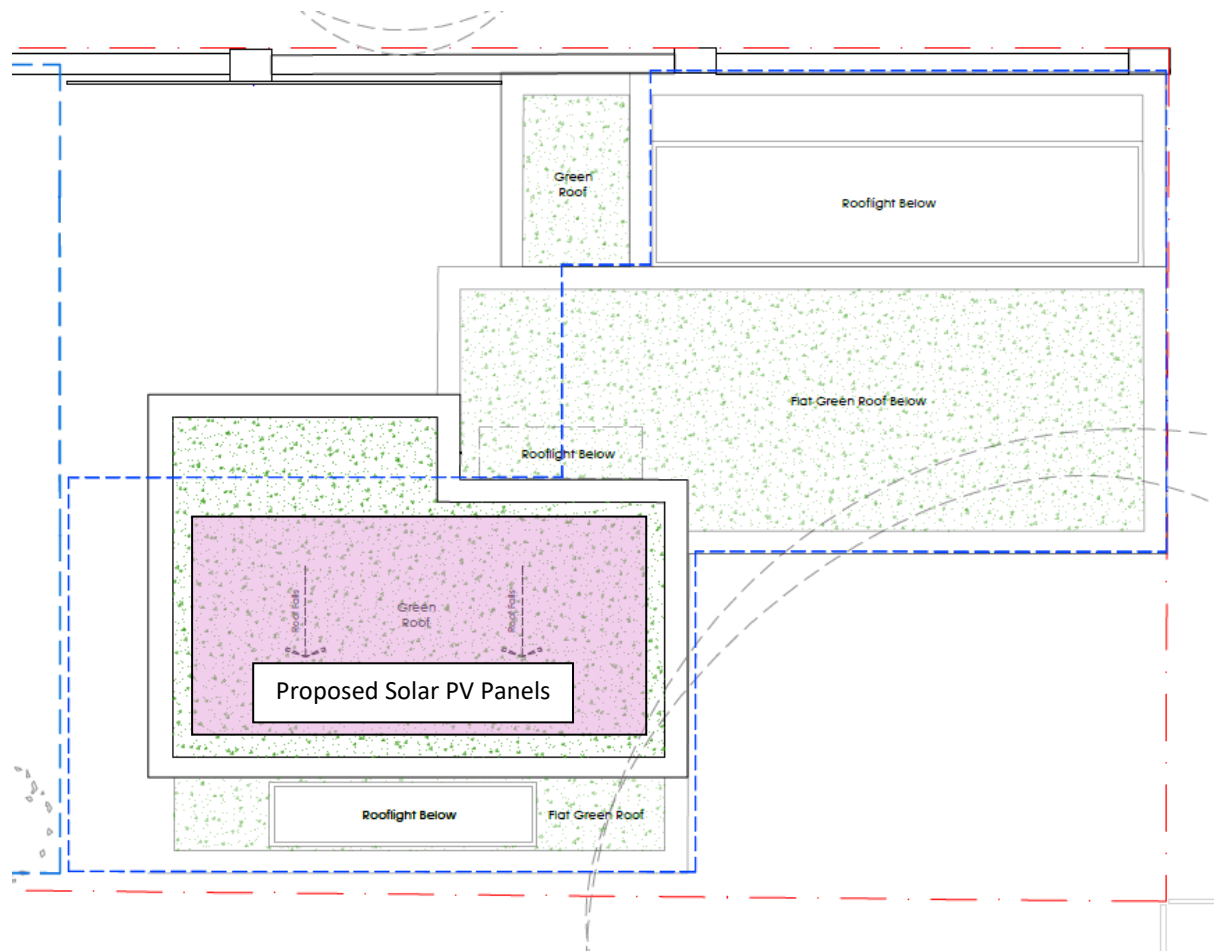


Figure 4 - Proposed Solar PV Panels Location

4.4.4 Be Green Stage Results

The table below shows the carbon emission results for the proposed dwelling under the Be Green stage of the assessment.

Table 6 - Be Green Stage Carbon Emission Results

Unit	Area (m ²)	CO ₂ Emission Rate (kgCO ₂ /m ²)	Total CO ₂ Emissions (Tonnes of CO ₂)
New Dwelling - Be Green	70.34	4.09	0.29

The results show that the total Target CO₂ emissions for the development under the Be Green stage are estimated to be 0.29 Tonnes of CO₂ per annum. In comparison to the Baseline emissions of 1.29 Tonnes of CO₂ per annum, this is a 78% improvement.

The London Plan aspirational target of at least a 50% improvement over building regulations is therefore comfortably satisfied, as is the requirement of at least a 20% reduction from on-site renewables.

The proposed dwelling Energy Use Intensity and Space Heating Demands can be seen in the table below. In comparison to the target values, they are higher, which maybe because the proposed dwelling has more glazing than the notional baseline.

The Energy use intensity also includes for unregulated energy loads such as cooking and appliances which when calculated using the BRE methodology are very high. The exact cooker and other appliances would need to be known to get a true estimation of the unregulated loads at the planning stage. Any white goods installed will be highly efficient to reduce the true unregulated loads as much as possible in the dwelling, however these are not known at this time.

Table 7 - Energy Use Intensity and Space heating Demand Values

EUI (kWh/m ² /year) (excluding renewable energy)	Space heating demand (kWh/m ² /year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m ² /year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m ² /year) (excluding renewable energy)
74.13	35.48	35	15

Although these values do not quite meet the targets, the dwelling overall has been shown to be extremely environmentally friendly.

4.5 Carbon Offset Payment

The final results show that the dwelling would still be emitting 0.29 tonnes of CO₂ per annum. In order to off-set this remaining amount of carbon a cash in lieu contribution can be made to the local authority. The carbon is priced at £95 per tonne for a period of 30 years.

The total cash in lieu contribution required for the development would therefore be:

$$0.29 \text{ Tonnes} \times £95 \times 30 \text{ years} = £826.50$$

5.0 Overheating Analysis

5.1 Cooling Hierarchy

In collaboration with the Energy Assessment of the development, an analysis of the overheating strategy within the building has also been carried out.

1. Minimise Internal Heat Gains

To minimise internal heat gains low energy lighting will be used throughout the development. Any new heating pipework will also be well insulated, white goods and computer equipment should also be of the highest efficiency.

2. Reduce the Amount of Heat Entering the Building

Highly efficient constructions with good U-Values will reduce the amount of heat transferring through to the dwelling.

3. Use of Thermal Mass and High Ceilings to Manage Heat within the Building

The building will have a medium thermal mass and it will be well insulated with an improved air permeability value to stop heat from first entering the building.

4. Passive Ventilation

Windows and doors will be openable to allow for fresh air when required.

5. Mechanical Ventilation

A whole house Mechanical supply and extract ventilation system has also been proposed to provide heat recovered fresh air in winter months. The system should also have a summer bypass option to provide outside air directly in the summer months. It will also be able to provide a secure form of nighttime ventilation.

The cooling hierarchy described above indicates that there should be minimal overheating risk to the new dwelling. A full Building Regulations Part O Overheating assessment will be carried out at later design stages to prove this.



Appendix A - Be Lean Stage SAP 2021 Calculation Sheets and Predicted Energy Assessment

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Thu 16 May 2024 08:41:28

Project Information			
Assessed By	Darren Coham	Building Type	House, Detached
OCDEA Registration	EES/022007	Assessment Date	2024-05-16

Dwelling Details			
Assessment Type	As designed	Total Floor Area	70 m ²
Site Reference	46 Priory Road	Plot Reference	Be Lean
Address	46 Priory Road, Hornsey, N8 7EX		

Client Details	
Name	District
Company	District Architetcs
Address	Studio 4, Blackwater Court, 17-19 Blackwater Street, London, SE22 8SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	18.55 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	18.82 kgCO ₂ /m ²		FAIL
1b Target primary energy rate and dwelling primary energy			
Target primary energy	98.37 kWh _{PE} /m ²		
Dwelling primary energy	113.61 kWh _{PE} /m ²		FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	73.1 kWh/m ²		
Dwelling fabric energy efficiency	57.9 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.13	Heatloss Floor 1 (0.13)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	w1 (1.2)	OK
Rooflights	2.2	1.2	RL1, East (1.2)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	132.4597	0.18
Ground floor: Heatloss Floor 1, Heatloss Floor 1	53.24	0.13
Exposed roof: Roof (1)	50.1195	0.11
Exposed roof: Roof (2)	3.1836	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
w1, Windows	4.6215	West	0.7	1.2
d1, Windows	1.89	South	0.7	1.2
w3, Windows	5.2962	East	0.7	1.2
w4, Windows	2.2116	East	0.7	1.2
fw1, Windows	5.72	West	0.7	1.2
fw2, Windows	1.611	West	0.7	1.2
RL1, Roof Window	2.0945	East	0.7	1.2
RL2, Roof Window	1.026	East	0.7	1.2
RL3, Roof Window	7.1064	West	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))	
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Government-approved scheme	0.0638	
External wall	E3: Sill	Government-approved scheme	0.02 (!)	
External wall	E4: Jamb	Government-approved scheme	0.015 (!)	
External wall	E5: Ground floor (normal)	Government-approved scheme	0.051	
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.001 (!)	
External wall	E16: Corner (normal)	Government-approved scheme	0.038 (!)	
Roof	R11: Upstands or kerbs of rooflights	SAP table default	0.24	
External wall	E17: Corner (inverted - internal area greater than external area)	Government-approved scheme	-0.074	
External wall	E15: Flat roof with parapet	Government-approved scheme	0.084	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	5 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Mains gas

Efficiency	88.9%
Emitter type	Both radiators and underfloor
Flow temperature	60°C
System type	Combi
Manufacturer	Notional
Model	Notional
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: N/A

Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A

Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

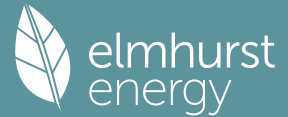
Manufacturer	
Model	

7 Lighting

Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	1.02 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	93%	OK
Manufacturer/Model	ComfoAir 200	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Property Reference	46 Priory Road				Issued on Date	16/05/2024
Assessment Reference	Be Lean	Prop Type Ref		Dwelling		
Property	46, Priory Road, Hornsey, London, N8 7EX					
SAP Rating	76 C	DER	18.82	TER	18.55	
Environmental	85 B	% DER < TER				-1.46
CO ₂ Emissions (t/year)	1.17	DFEE	57.91	TFEE	73.06	
Compliance Check	See BREL	% DFEE < TFEE				20.74
% DPER < TPER	-15.49	DPER	113.61	TPER	98.37	
Assessor Details	Mr. Darren Coham				Assessor ID	R789-0001
Client	District Architetcs, District					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (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	5.0000 (17)											
Infiltration rate	0.2500 (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) = 0.2125 (21)											
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.3524	0.3471	0.3418	0.3152	0.3099	0.2834	0.2834	0.2781	0.2940	0.3099	0.3206	0.3312 (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
Windows (Uw = 1.20)			21.3500	1.1450	24.4466		(27)
RL1			2.0900	1.1450	2.3931		(27a)
RL2			1.0300	1.1450	1.1794		(27a)
RL3			7.1100	1.1450	8.1412		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000 (28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680 (29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800 (30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200 (30)
Total net area of external elements Aum(A, m ²)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.7871		(33)
Internal Wall 1			90.0000			9.0000	810.0000 (32c)
Internal Floor 1			17.1000			18.0000	307.8000 (32d)
Internal Ceiling 1			17.1000			9.0000	153.9000 (32e)

$$(28) \dots (30) + (32) + (32a) \dots (32e) = 22178.2680 \quad (34)$$

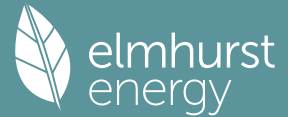
$$315.3009 \quad (35)$$

Water heating energy requirements (kWh/year)												
Assumed occupancy												2.2544 (42)
Hot water usage for mixer showers	85.2743	83.9928	82.1254	78.5525	75.9157	72.9753	71.3039	73.1572	75.1887	78.3459	81.9956	84.9476 (42a)
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023 (42b)
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168 (42c)
Average daily hot water use (litres/day)												137.7493 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667 (44)
Energy content (annual)	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722 (45)
Distribution loss (46)m = 0.15 x (45)m	35.5832	31.3419	32.9526	28.1229	26.6898	23.4250	22.6529	23.8945	24.5374	28.1114	30.8121	35.0808 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311 (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	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2888.0299 (64)
Electric shower(s)												2888 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	91.6158	80.9814	85.7846	74.6679	71.9021	64.2542	62.9536	65.7059	66.7201	75.0533	80.6289	90.5022 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.9133	110.6183	99.9133	103.2437	99.9133	103.2437	99.9133	99.9133	103.2437	99.9133	103.2437	99.9133 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	123.1395	120.5080	115.3019	103.7054	96.6426	89.2420	84.6150	88.3144	92.6668	100.8780	111.9845	121.6428 (72)
Total internal gains	480.9574	491.0864	469.9954	450.7020	426.3886	406.2354	389.5378	391.1816	404.0443	422.9526	451.3097	470.7204 (73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	7.5100	19.6403	0.6300	0.7000	0.7700	45.0774 (76)
South	1.8900	46.7521	0.6300	0.7000	0.7700	27.0044 (78)
West	11.9500	19.6403	0.6300	0.7000	0.7700	71.7277 (80)
East	3.1200	26.0000	0.6300	0.7000	1.0000	32.1965 (82)
West	7.1100	26.0000	0.6300	0.7000	1.0000	73.3709 (82)

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Solar gains	249.3770	491.9774	822.4237	1221.5262	1518.5139	1564.4245	1485.2760	1261.1120	963.4352	586.8104	311.6412	204.6552 (83)
Total gains	730.3344	983.0638	1292.4191	1672.2281	1944.9024	1970.6599	1874.8138	1652.2935	1367.4795	1009.7630	762.9508	675.3756 (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	56.9161	57.0963	57.2777	58.2023	58.3908	59.3520	59.3520	59.5480	58.9637	58.3908	58.0150	57.6440
alpha	4.7944	4.8064	4.8185	4.8802	4.8927	4.9568	4.9568	4.9699	4.9309	4.8927	4.8677	4.8429
util living area	0.9922	0.9708	0.8958	0.7043	0.4956	0.3361	0.2434	0.2876	0.5163	0.8629	0.9801	0.9945 (86)
MIT	19.9664	20.2346	20.5757	20.8439	20.9210	20.9357	20.9372	20.9370	20.9238	20.7334	20.2820	19.9276 (87)
Th 2	19.6585	19.6621	19.6657	19.6839	19.6875	19.7058	19.7058	19.7095	19.6985	19.6875	19.6803	19.6730 (88)
util rest of house	0.9890	0.9599	0.8637	0.6450	0.4292	0.2686	0.1719	0.2072	0.4240	0.8081	0.9708	0.9922 (89)
MIT 2	18.4962	18.8336	19.2385	19.5299	19.5970	19.6250	19.6256	19.6294	19.6120	19.4414	18.9123	18.4585 (90)
Living area fraction									fLA = Living area / (4) =			0.3455 (91)
MIT	19.0041	19.3176	19.7005	19.9839	20.0544	20.0778	20.0787	20.0811	20.0652	19.8877	19.3855	18.9660 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8541	19.1676	19.5505	19.8339	19.9044	19.9278	19.9287	19.9311	19.9152	19.7377	19.2355	18.8160 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9864	0.9548	0.8604	0.6521	0.4403	0.2803	0.1843	0.2210	0.4397	0.8105	0.9667	0.9901 (94)
Useful gains	720.3927	938.6269	1112.0568	1090.5240	856.3954	552.2814	345.4492	365.1607	601.3445	818.4393	737.5103	668.7184 (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	1575.3434	1539.4563	1403.6696	1157.3329	865.6240	553.0132	345.5136	365.3180	607.5781	964.0944	1288.6737	1562.0684 (97)
Space heating kWh	636.0833	403.7573	216.9599	48.1025	6.8661	0.0000	0.0000	0.0000	0.0000	108.3674	396.8377	664.6524 (98a)
Space heating requirement - total per year (kWh/year)												2481.6265
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	636.0833	403.7573	216.9599	48.1025	6.8661	0.0000	0.0000	0.0000	0.0000	108.3674	396.8377	664.6524 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2481.6265
Space heating per m2										(98c) / (4) =		35.2804 (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 %)												88.9000 (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	636.0833	403.7573	216.9599	48.1025	6.8661	0.0000	0.0000	0.0000	0.0000	108.3674	396.8377	664.6524 (98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000 (210)
Space heating fuel (main heating system)	715.5042	454.1702	244.0493	54.1085	7.7234	0.0000	0.0000	0.0000	0.0000	121.8981	446.3866	747.6405 (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	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311 (64)
Efficiency of water heater (217)m	86.0273	85.3614	83.9119	81.6333	80.5269	80.3000	80.3000	80.3000	80.3000	82.8035	85.3273	86.1327 (217)
Fuel for water heating, kWh/month	275.7511	244.7780	261.8031	229.6687	220.9597	194.4792	188.0686	198.3770	203.7146	226.3300	240.7362	271.5253 (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	83.2822	75.2226	83.2822	80.5957	83.2822	80.5957	83.2822	83.2822	80.5957	83.2822	80.5957	83.2822 (231)
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542 (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												2791.4809 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												80.3000
Water heating fuel used												2756.1917 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4280)

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mechanical ventilation fans (SFP = 1.4280)	339.5808 (230a)
central heating pump	41.0000 (230c)
maintaining electric keep-hot facility for gas combi boiler	600.0000 (230f)
Total electricity for the above, kWh/year	980.5808 (231)
Electricity for lighting (calculated in Appendix L)	155.9017 (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	6684.1551 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2791.4809	0.2100	586.2110 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	2756.1917	0.2100	578.8003 (264)	
Space and water heating			1165.0112 (265)	
Pumps, fans and electric keep-hot	980.5808	0.1387	136.0186 (267)	
Energy for lighting	155.9017	0.1443	22.5014 (268)	
Total CO2, kg/year			1323.5313 (272)	
EPC Dwelling Carbon Dioxide Emission Rate (DER)			18.8200 (273)	

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2791.4809	1.1300	3154.3734 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	2756.1917	1.1300	3114.4966 (278)	
Space and water heating			6268.8700 (279)	
Pumps, fans and electric keep-hot	980.5808	1.5128	1483.4226 (281)	
Energy for lighting	155.9017	1.5338	239.1273 (282)	
Total Primary energy kWh/year			7991.4199 (286)	
Dwelling Primary energy Rate (DPER)			113.6100 (287)	

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

1. Overall dwelling characteristics

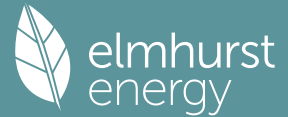
	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)	
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1539 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4039	(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) =	0.3433 (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	0.4377	0.4292	0.4206	0.3777	0.3691	0.3262	0.3262	0.3176	0.3433	0.3691	0.3862	0.4034 (22b)
Effective ac	0.5958	0.5921	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5814 (25)

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3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			11.8900	1.1450	13.6145			(27)
RL1			1.1600	2.0221	2.3456			(27a)
RL2			0.5700	2.0221	1.1526			(27a)
RL3			3.9600	2.0221	8.0074			(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212			(28a)
External Wall 1	153.8088	11.8900	141.9188	0.1800	25.5454			(29a)
Green Roof	53.2400	1.7300	51.5100	0.1100	5.6661			(30)
Flat Roof	10.2900	3.9600	6.3300	0.1100	0.6963			(30)
Total net area of external elements Aum(A, m ²)			270.5788					(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	63.9490			(33)

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

315.3009 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	11.5400	0.0500	0.5770	
E3 Sill	10.6400	0.0500	0.5320	
E4 Jamb	22.0500	0.0500	1.1025	
E5 Ground floor (normal)	37.7800	0.1600	6.0448	
E6 Intermediate floor within a dwelling	17.9800	0.0000	0.0000	
E16 Corner (normal)	32.9200	0.0900	2.9628	
R11 Upstands or kerbs of rooflights	24.8100	0.0800	1.9848	
E17 Corner (inverted - internal area greater than external area)	11.0800	-0.0900	-0.9972	
E15 Flat roof with parapet	37.7800	0.5600	21.1568	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				33.3635 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	97.3125 (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	38.3243	38.0850	37.8505	36.7487	36.5426	35.5830	35.5830	35.4053	35.9526	36.5426	36.9596	37.3956	(38)
Heat transfer coeff	135.6368	135.3975	135.1630	134.0612	133.8551	132.8955	132.8955	132.7178	133.2651	133.8551	134.2721	134.7081	(39)
Average = Sum(39)m / 12 =												134.0602	
HLP	1.9283	1.9249	1.9216	1.9059	1.9030	1.8893	1.8893	1.8868	1.8946	1.9030	1.9089	1.9151	(40)
HLP (average)												1.9059	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

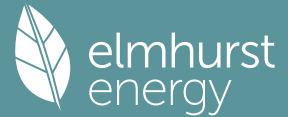
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2544 (42)
Hot water usage for mixer showers	62.0177	61.0857	59.7276	57.1291	55.2114	53.0729	51.8574	53.2052	54.6827	56.9788	59.6331	61.7801	(42a)
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023	(42b)
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168	(42c)
Average daily hot water use (litres/day)												116.3075	(43)
Daily hot water use	126.5274	123.8259	120.5360	115.5328	111.4700	107.1021	105.4232	108.6990	112.1538	116.7394	121.8197	126.1992	(44)
Energy conte	200.3884	176.3265	185.2593	158.1586	150.0600	131.6945	127.5002	134.5921	138.2969	158.4142	173.5545	197.5974	(45)
Energy content (annual)										Total = Sum(45)m =		1931.8427	
Distribution loss (46)m = 0.15 x (45)m	30.0583	26.4490	27.7889	23.7238	22.5090	19.7542	19.1250	20.1888	20.7445	23.7621	26.0332	29.6396	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	251.3473	222.3539	236.2182	207.4736	201.0189	181.0096	178.4591	185.5510	187.6120	209.3732	222.8695	248.5563	(62)
WWHRS	-28.3519	-25.0747	-26.2567	-21.7416	-20.2624	-17.3387	-16.2523	-17.2826	-17.9393	-21.1484	-23.9586	-27.8269	(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	222.9954	197.2792	209.9615	185.7320	180.7565	163.6709	162.2069	168.2683	169.6727	188.2247	198.9109	220.7295	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2268.4086	(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	79.3689	70.1354	74.3384	64.9165	62.6347	56.1172	55.1336	57.4916	58.3125	65.4125	70.0356	78.4409	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.9133	110.6183	99.9133	103.2437	99.9133	103.2437	99.9133	99.9133	103.2437	99.9133	103.2437	99.9133	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	106.6786	104.3682	99.9173	90.1618	84.1864	77.9406	74.1042	77.2736	80.9896	87.9200	97.2717	105.4313	(72)
Total internal gains	464.4965	474.9466	454.6108	437.1583	413.9323	394.9340	379.0270	380.1408	392.3671	409.9945	436.5968	454.5089	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East				4.1800	19.6403	0.6300		0.7000	0.7700		25.0897 (76)	
South				1.0500	46.7521	0.6300		0.7000	0.7700		15.0024 (78)	
West				6.6600	19.6403	0.6300		0.7000	0.7700		39.9755 (80)	
East				1.7300	26.0000	0.6300		0.7000	1.0000		17.8526 (82)	
West				3.9600	26.0000	0.6300		0.7000	1.0000		40.8648 (82)	
Solar gains	138.7850	273.8029	457.7147	679.8373	845.1253	870.6760	826.6265	701.8691	536.1958	326.5829	173.4375	113.8955 (83)
Total gains	603.2814	748.7494	912.3255	1116.9956	1259.0577	1265.6100	1205.6535	1082.0099	928.5629	736.5774	610.0343	568.4044 (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	45.4200	45.5003	45.5793	45.9539	46.0246	46.3569	46.3569	46.4190	46.2284	46.0246	45.8817	45.7332
alpha	4.0280	4.0334	4.0386	4.0636	4.0683	4.0905	4.0905	4.0946	4.0819	4.0683	4.0588	4.0489
util living area	0.9964	0.9911	0.9751	0.9195	0.7981	0.6221	0.4717	0.5393	0.7993	0.9632	0.9928	0.9972 (86)
MIT	19.1191	19.3741	19.7891	20.3253	20.7278	20.9281	20.9818	20.9693	20.7986	20.2258	19.5712	19.0792 (87)
Th 2	19.3816	19.3839	19.3861	19.3968	19.3988	19.4081	19.4081	19.4099	19.4045	19.3988	19.3948	19.3905 (88)
util rest of house	0.9948	0.9872	0.9636	0.8830	0.7153	0.4891	0.3078	0.3652	0.6817	0.9388	0.9888	0.9960 (89)
MIT 2	17.2850	17.6107	18.1339	18.7844	19.2098	19.3791	19.4050	19.4036	19.2968	18.6911	17.8713	17.2398 (90)
Living area fraction	17.9186	18.2199	18.7057	19.3167	19.7342	19.9142	19.9497	19.9445	19.8157	19.2213	18.4585	17.8752 (92)
MIT	17.9186	18.2199	18.7057	19.3167	19.7342	19.9142	19.9497	19.9445	19.8157	19.2213	18.4585	17.8752 (93)
Temperature adjustment												0.0000
adjusted MIT	17.9186	18.2199	18.7057	19.3167	19.7342	19.9142	19.9497	19.9445	19.8157	19.2213	18.4585	17.8752 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9925	0.9829	0.9570	0.8807	0.7349	0.5341	0.3653	0.4265	0.7168	0.9351	0.9853	0.9941 (94)
Useful gains	598.7858	735.9625	873.0646	983.7820	925.3142	675.9715	440.3671	461.5106	665.6020	688.7806	601.0695	565.0322 (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	1847.1888	1803.4807	1649.7611	1396.4808	1075.4211	706.2345	445.1664	470.4187	761.6970	1154.0026	1525.1326	1842.1650 (97)
Space heating kWh	928.8118	717.3722	577.8622	297.1431	111.6795	0.0000	0.0000	0.0000	0.0000	346.1252	665.3254	950.1869 (98a)
Space heating requirement - total per year (kWh/year)												4594.5063
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	928.8118	717.3722	577.8622	297.1431	111.6795	0.0000	0.0000	0.0000	0.0000	346.1252	665.3254	950.1869 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4594.5063
Space heating per m ²										(98c) / (4) =		65.3185 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	928.8118	717.3722	577.8622	297.1431	111.6795	0.0000	0.0000	0.0000	0.0000	346.1252	665.3254	950.1869 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	1005.2076	776.3769	625.3920	321.5834	120.8652	0.0000	0.0000	0.0000	0.0000	374.5944	720.0492	1028.3408 (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	222.9954	197.2792	209.9615	185.7320	180.7565	163.6709	162.2069	168.2683	169.6727	188.2247	198.9109	220.7295 (64)
Efficiency of water heater	87.0941	86.8928	86.4330	85.3827	83.3804	80.3000	80.3000	80.3000	80.3000	85.6681	86.7614	80.3000 (216)
Fuel for water heating, kWh/month	256.0396	227.0375	242.9182	217.5288	216.7855	203.8243	202.0011	209.5496	211.2985	219.7138	229.2621	253.3024 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	20.7600	16.6545	14.9955	10.9863	8.4862	6.9333	7.7414	10.0625	13.0702	17.1488	19.3696	21.3370 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-44.9959	-61.1292	-84.7351	-91.8027	-96.2092	-88.8601	-87.7638	-84.1761	-77.4796	-68.2248	-48.6428	-39.1793 (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)												

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(233b)m	-32.9579	-68.2996	-133.8892	-198.4634	-259.9315	-260.2523	-257.1722	-218.8543	-161.9186	-96.7488	-43.6944	-26.1398	(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												4972.4094	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2689.2613	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												167.5452	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-2631.5204	(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												5283.6955	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4972.4094	0.2100	1044.2060	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2689.2613	0.2100	564.7449	(264)
Space and water heating			1608.9509	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	167.5452	0.1443	24.1819	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-873.1984	0.1354	-118.2019	
PV Unit electricity exported	-1758.3219	0.1263	-222.0596	
Total			-340.2616	(269)
Total CO2, kg/year			1304.8005	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.5500	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4972.4094	1.1300	5618.8226	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2689.2613	1.1300	3038.8653	(278)
Space and water heating			8657.6879	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	167.5452	1.5338	256.9864	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-873.1984	1.5003	-1310.0902	
PV Unit electricity exported	-1758.3219	0.4636	-815.1434	
Total			-2125.2336	(283)
Total Primary energy kWh/year			6919.5415	(286)
Target Primary Energy Rate (TPER)			98.3700	(287)

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

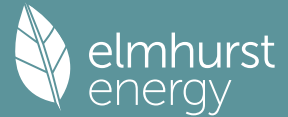
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)	
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 194.9194 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											Air changes per hour	
Pressure test												30.0000 / (5) =	0.1539 (8)
Pressure Test Method												Yes	
Measured/design AP50												Blower Door	
Infiltration rate												5.0000	(17)
Number of sides sheltered												0.4039	(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) =	0.3433 (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)
	0.4377	0.4292	0.4206	0.3777	0.3691	0.3262	0.3262	0.3176	0.3433	0.3691	0.3862	0.4034	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5958	0.5921	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5814	(25)

3. Heat losses and heat loss parameter

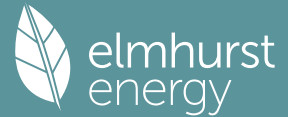
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			21.3500	1.1450	24.4466		(27)
RL1			2.0900	1.1450	2.3931		(27a)
RL2			1.0300	1.1450	1.1794		(27a)
RL3			7.1100	1.1450	8.1412		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000 (28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680 (29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800 (30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200 (30)
Total net area of external elements Aum(A, m ²)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		72.7871		(33)
Internal Wall 1			90.0000			9.0000	810.0000 (32c)
Internal Floor 1			17.1000			18.0000	307.8000 (32d)
Internal Ceiling 1			17.1000			9.0000	153.9000 (32e)
Heat capacity Cm = Sum(A x k)						(28) ... (30) + (32) + (32a) ... (32e) =	22178.2680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							315.3009 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				11.5400	0.0638	0.7363	
E3 Sill				10.6400	0.0200	0.2128	
E4 Jamb				22.0500	0.0150	0.3307	
E5 Ground floor (normal)				37.7800	0.0510	1.9268	
E6 Intermediate floor within a dwelling				17.9800	0.0010	0.0180	
E16 Corner (normal)				32.9200	0.0380	1.2510	
R11 Upstands or kerbs of rooflights				24.8100	0.2400	5.9544	
E17 Corner (inverted - internal area greater than external area)				11.0800	-0.0740	-0.8199	
E15 Flat roof with parapet				37.7800	0.0840	3.1735	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7835 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	85.5706 (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	38.3243	38.0850	37.8505	36.7487	36.5426	35.5830	35.5830	35.4053	35.9526	36.5426	36.9596	37.3956	(38)
Average = Sum(39)m / 12 =	123.8949	123.6556	123.4211	122.3193	122.1132	121.1536	121.1536	120.9759	121.5232	122.1132	122.5302	122.9662	(39)
													122.3183
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.7614	1.7580	1.7546	1.7390	1.7360	1.7224	1.7224	1.7199	1.7277	1.7360	1.7420	1.7482	(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												2.2544	(42)
Hot water usage for mixer showers												0.0000	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023	(42c)
Average daily hot water use (litres/day)	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168	(43)
													59.1292
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	64.5097	62.7402	60.8084	58.4037	56.2585	54.0292	53.5658	55.4938	57.4711	59.7606	62.1865	64.4191	(44)
Energy content (annual)	102.1676	89.3413	93.4602	79.9517	75.7348	66.4352	64.7832	68.7129	70.8677	81.0945	88.5961	100.8647	(45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m =	982.0100
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	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	86.8424	75.9401	79.4412	67.9590	64.3746	56.4699	55.0657	58.4060	60.2375	68.9303	75.3067	85.7350	(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	86.8424	75.9401	79.4412	67.9590	64.3746	56.4699	55.0657	58.4060	60.2375	68.9303	75.3067	85.7350	(64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m =	834.7085 (64)
												835	(64)

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Electric shower(s)	49.6658	44.2527	48.3222	46.1133	46.9786	44.8130	46.3068	46.9786	46.1133	48.3222	47.4136	49.6658 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												564.9461 (64a)
Heat gains from water heating, kWh/month	34.1271	30.0482	31.9409	28.5181	27.8383	25.3207	25.3431	26.3461	26.5877	29.3131	30.6801	33.8502 (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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.9133	110.6183	99.9133	103.2437	99.9133	103.2437	99.9133	99.9133	103.2437	99.9133	103.2437	99.9133 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	45.8697	44.7146	42.9313	39.6084	37.4171	35.1677	34.0634	35.4115	36.9274	39.3994	42.6112	45.4976 (72)
Total internal gains	400.6876	412.2930	394.6248	383.6050	364.1630	352.1611	338.9861	338.2787	348.3049	358.4739	378.9363	391.5752 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W		
East				7.5100	19.6403	0.6300		0.7000	0.7700	45.0774 (76)		
South				1.8900	46.7521	0.6300		0.7000	0.7700	27.0044 (78)		
West				11.9500	19.6403	0.6300		0.7000	0.7700	71.7277 (80)		
East				3.1200	26.0000	0.6300		0.7000	1.0000	32.1965 (82)		
West				7.1100	26.0000	0.6300		0.7000	1.0000	73.3709 (82)		
Solar gains	249.3770	491.9774	822.4237	1221.5262	1518.5139	1564.4245	1485.2760	1261.1120	963.4352	586.8104	311.6412	204.6552 (83)
Total gains	650.0646	904.2704	1217.0485	1605.1311	1882.6769	1916.5856	1824.2621	1599.3906	1311.7402	945.2843	690.5775	596.2304 (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	49.7246	49.8209	49.9155	50.3651	50.4502	50.8497	50.8497	50.9244	50.6951	50.4502	50.2785	50.1002
alpha	4.3150	4.3214	4.3277	4.3577	4.3633	4.3900	4.3900	4.3950	4.3797	4.3633	4.3519	4.3400
util living area	0.9953	0.9817	0.9308	0.7790	0.5750	0.4000	0.2913	0.3457	0.6035	0.9113	0.9882	0.9968 (86)
MIT	19.3556	19.7237	20.2398	20.7335	20.9383	20.9898	20.9980	20.9959	20.9456	20.5259	19.8164	19.2952 (87)
Th 2	19.4972	19.4996	19.5019	19.5130	19.5151	19.5248	19.5248	19.5266	19.5211	19.5151	19.5109	19.5065 (88)
util rest of house	0.9933	0.9742	0.9053	0.7185	0.4937	0.3100	0.1941	0.2362	0.4897	0.8661	0.9822	0.9953 (89)
MIT 2	18.0665	18.4301	18.9198	19.3449	19.4862	19.5220	19.5246	19.5260	19.5019	19.2018	18.5340	18.0135 (90)
Living area fraction	18.5118	18.8770	19.3758	19.8246	19.9878	20.0291	20.0336	20.0338	20.0007	19.6593	18.9771	18.4563 (92)
Temperature adjustment	18.5118	18.8770	19.3758	19.8246	19.9878	20.0291	20.0336	20.0338	20.0007	19.6593	18.9771	18.4563 (93)
adjusted MIT	18.5118	18.8770	19.3758	19.8246	19.9878	20.0291	20.0336	20.0338	20.0007	19.6593	18.9771	18.4563 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	644.4703	877.1716	1098.6344	1175.3150	979.7046	653.7887	415.5045	438.5114	693.0555	823.7257	676.1565	592.5703 (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	1760.7754	1728.3334	1589.1460	1336.2909	1012.0541	657.7503	415.9926	439.6049	717.0688	1106.2550	1455.2994	1753.0367 (97)
Space heating kWh	830.5310	571.9808	364.9407	115.9026	24.0680	0.0000	0.0000	0.0000	0.0000	210.2018	560.9828	863.3870 (98a)
Space heating requirement - total per year (kWh/year)	3541.9946											
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	830.5310	571.9808	364.9407	115.9026	24.0680	0.0000	0.0000	0.0000	0.0000	210.2018	560.9828	863.3870 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3541.9946											
Space heating per m ²	(98c) / (4) = 50.3553 (99)											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1138.8441	896.5368	919.4170	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9657	0.9825	0.9698	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1099.8301	880.8109	891.6232	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2065.4551	1967.0391	1728.0777	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	695.2501	808.1538	622.3222	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) = 1.0000 (105)											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	173.8125	202.0384	155.5805	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												531.4315 (107)
Energy for space heating												50.3553 (99)
Energy for space cooling												7.5552 (108)
Total												57.9105 (109)
Fabric Energy Efficiency (DFEE)												57.9 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1539 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4039 (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) = 0.3433 (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	0.4377	0.4292	0.4206	0.3777	0.3691	0.3262	0.3262	0.3176	0.3433	0.3691	0.3862	0.4034 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5958	0.5921	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5814 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			11.8900	1.1450	13.6145		(27)
RL1			1.1600	2.0221	2.3456		(27a)
RL2			0.5700	2.0221	1.1526		(27a)
RL3			3.9600	2.0221	8.0074		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212		(28a)
External Wall 1	153.8088	11.8900	141.9188	0.1800	25.5454		(29a)
Green Roof	53.2400	1.7300	51.5100	0.1100	5.6661		(30)
Flat Roof	10.2900	3.9600	6.3300	0.1100	0.6963		(30)
Total net area of external elements Aum(A, m ²)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.9490		(33)

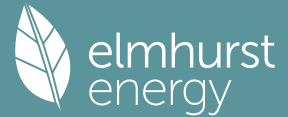
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 315.3009 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	11.5400	0.0500	0.5770
E2 Other lintels (including other steel lintels)	10.6400	0.0500	0.5320
E3 Sill	22.0500	0.0500	1.1025
E4 Jamb	37.7800	0.1600	6.0448
E5 Ground floor (normal)	17.9800	0.0000	0.0000
E6 Intermediate floor within a dwelling	32.9200	0.0900	2.9628
E16 Corner (normal)	24.8100	0.0800	1.9848
R11 Upstands or kerbs of rooflights	11.0800	-0.0900	-0.9972
E17 Corner (inverted - internal area greater than external area)	37.7800	0.5600	21.1568
E15 Flat roof with parapet			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			33.3635 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 97.3125 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	38.3243	38.0850	37.8505	36.7487	36.5426	35.5830	35.5830	35.4053	35.9526	36.5426	36.9596	37.3956 (38)
Heat transfer coeff	135.6368	135.3975	135.1630	134.0612	133.8551	132.8955	132.8955	132.7178	133.2651	133.8551	134.2721	134.7081 (39)
Average = Sum(39)m / 12 =												134.0602

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.9283	1.9249	1.9216	1.9059	1.9030	1.8893	1.8893	1.8868	1.8946	1.9030	1.9089	1.9151 (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												2.2544 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023 (42b)
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168 (42c)
Average daily hot water use (litres/day)												59.1292 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	64.5097	62.7402	60.8084	58.4037	56.2585	54.0292	53.5658	55.4938	57.4711	59.7606	62.1865	64.4191 (44)
Energy content (annual)	102.1676	89.3413	93.4602	79.9517	75.7348	66.4352	64.7832	68.7129	70.8677	81.0945	88.5961	100.8647 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	86.8424	75.9401	79.4412	67.9590	64.3746	56.4699	55.0657	58.4060	60.2375	68.9303	75.3067	85.7350 (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	86.8424	75.9401	79.4412	67.9590	64.3746	56.4699	55.0657	58.4060	60.2375	68.9303	75.3067	85.7350 (64)
12Total per year (kWh/year)												834.7085 (64)
Electric shower(s)	49.6658	44.2527	48.3222	46.1133	46.9786	44.8130	46.3068	46.9786	46.1133	48.3222	47.4136	49.6658 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												564.9461 (64a)
Heat gains from water heating, kWh/month	34.1271	30.0482	31.9409	28.5181	27.8383	25.3207	25.3431	26.3461	26.5877	29.3131	30.6801	33.8502 (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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.9133	110.6183	99.9133	103.2437	99.9133	103.2437	99.9133	99.9133	103.2437	99.9133	103.2437	99.9133 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	45.8697	44.7146	42.9313	39.6084	37.4171	35.1677	34.0634	35.4115	36.9274	39.3994	42.6112	45.4976 (72)
Total internal gains	400.6876	412.2930	394.6248	383.6050	364.1630	352.1611	338.9861	338.2787	348.3049	358.4739	378.9363	391.5752 (73)

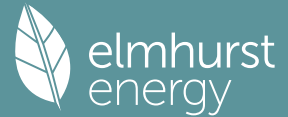
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				4.1800	19.6403		0.6300		0.7000		0.7700		25.0897 (76)
South				1.0500	46.7521		0.6300		0.7000		0.7700		15.0024 (78)
West				6.6600	19.6403		0.6300		0.7000		0.7700		39.9755 (80)
East				1.7300	26.0000		0.6300		0.7000		1.0000		17.8526 (82)
West				3.9600	26.0000		0.6300		0.7000		1.0000		40.8648 (82)
Solar gains	138.7850	273.8029	457.7147	679.8373	845.1253	870.6760	826.6265	701.8691	536.1958	326.5829	173.4375	113.8955	(83)
Total gains	539.4726	686.0958	852.3395	1063.4422	1209.2883	1222.8371	1165.6126	1040.1477	884.5007	685.0568	552.3738	505.4707	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	45.4200	45.5003	45.5793	45.9539	46.0246	46.3569	46.3569	46.4190	46.2284	46.0246	45.8817	45.7332
util living area	4.0280	4.0334	4.0386	4.0636	4.0683	4.0905	4.0905	4.0946	4.0819	4.0683	4.0588	4.0489
	0.9976	0.9935	0.9801	0.9298	0.8142	0.6386	0.4863	0.5576	0.8185	0.9708	0.9950	0.9982 (86)
MIT	19.0480	19.3057	19.7278	20.2819	20.7048	20.9209	20.9797	20.9654	20.7779	20.1754	19.5077	19.0087 (87)
Th 2	19.3816	19.3839	19.3861	19.3968	19.3988	19.4081	19.4081	19.4099	19.4045	19.3988	19.3948	19.3905 (88)
util rest of house	0.9966	0.9905	0.9707	0.8967	0.7339	0.5043	0.3181	0.3793	0.7047	0.9507	0.9921	0.9974 (89)
MIT 2	17.6770	17.9347	18.3517	18.8825	19.2365	19.3828	19.4054	19.4043	19.3096	18.8016	18.1449	17.6443 (90)
Living area fraction									fLA = Living area / (4) =			0.3455 (91)

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MIT	18.1506	18.4083	18.8271	19.3660	19.7438	19.9142	19.9493	19.9436	19.8168	19.2762	18.6157	18.1156 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1506	18.4083	18.8271	19.3660	19.7438	19.9142	19.9493	19.9436	19.8168	19.2762	18.6157	18.1156 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9879	0.9663	0.8959	0.7536	0.5500	0.3772	0.4424	0.7392	0.9486	0.9901	0.9964	(94)
Useful gains	536.9427	677.8202	823.5756	952.7781	911.2623	672.5888	439.6989	460.1273	653.8161	649.8178	546.9009	503.6376	(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	1878.6557	1828.9944	1666.1642	1403.0800	1076.6981	706.2306	445.1013	470.2946	761.8554	1161.3574	1546.2385	1874.5485	(97)
Space heating kWh	998.2345	773.5890	626.8859	324.2174	123.0842	0.0000	0.0000	0.0000	0.0000	380.5855	719.5231	1019.9576	(98a)
Space heating requirement - total per year (kWh/year)												4966.0772	
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	998.2345	773.5890	626.8859	324.2174	123.0842	0.0000	0.0000	0.0000	0.0000	380.5855	719.5231	1019.9576	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4966.0772	
Space heating per m2										(98c) / (4) =		70.6010	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1249.2179	983.4268	1008.6554	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8237	0.8877	0.8441	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1029.0219	872.9657	851.3735	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1315.4246	1254.6868	1122.1799	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	206.2099	284.0005	201.4799	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	51.5525	71.0001	50.3700	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												172.9226 (107)
Energy for space heating												70.6010 (99)
Energy for space cooling												2.4584 (108)
Total												73.0594 (109)
Fabric Energy Efficiency (TFEE)												73.1 (109)

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

1. Overall dwelling characteristics

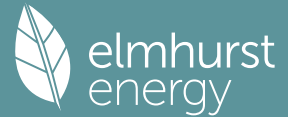
	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	53.2400 (1b)	x	2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x	2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	194.9194 (5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
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	5.0000	(17)
Infiltration rate	0.2500	(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) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497	(22b)

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Balanced mechanical ventilation with heat recovery

If mechanical ventilation

0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)

0.5000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

83.7000 (23c)

Effective ac	0.3524	0.3471	0.3418	0.3152	0.3099	0.2834	0.2834	0.2781	0.2940	0.3099	0.3206	0.3312 (25)
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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	
Windows (Uw = 1.20)			21.3500	1.1450	24.4466			(27)
RL1			2.0900	1.1450	2.3931			(27a)
RL2			1.0300	1.1450	1.1794			(27a)
RL3			7.1100	1.1450	8.1412			(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000	(28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680	(29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800	(30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200	(30)
Total net area of external elements Aum(A, m ²)			270.5788					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7871			(33)
Internal Wall 1			90.0000			9.0000	810.0000	(32c)
Internal Floor 1			17.1000			18.0000	307.8000	(32d)
Internal Ceiling 1			17.1000			9.0000	153.9000	(32e)

Heat capacity Cm = Sum(A x k)

(28)...(30) + (32) + (32a)...(32e) = 22178.2680 (34)

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

315.3009 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	11.5400	0.0638	0.7363
E2 Other lintels (including other steel lintels)	10.6400	0.0200	0.2128
E3 Sill	22.0500	0.0150	0.3307
E4 Jamb	37.7800	0.0510	1.9268
E5 Ground floor (normal)	17.9800	0.0010	0.0180
E6 Intermediate floor within a dwelling	32.9200	0.0380	1.2510
E16 Corner (normal)	24.8100	0.2400	5.9544
R11 Upstands or kerbs of rooflights	11.0800	-0.0740	-0.8199
E17 Corner (inverted - internal area greater than external area)	37.7800	0.0840	3.1735
E15 Flat roof with parapet			

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

12.7835 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 85.5706 (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	
	22.6700	22.3283	21.9865	20.2780	19.9362	18.2276	18.2276	17.8859	18.9111	19.9362	20.6197	21.3031	(38)
Heat transfer coeff	108.2406	107.8989	107.5572	105.8486	105.5068	103.7983	103.7983	103.4565	104.4817	105.5068	106.1903	106.8737	(39)
Average = Sum(39)m / 12 =												105.7631	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5388	1.5340	1.5291	1.5048	1.5000	1.4757	1.4757	1.4708	1.4854	1.5000	1.5097	1.5194	(40)
HLP (average)												1.5036	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

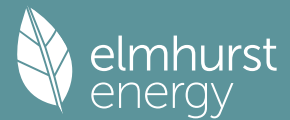
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2544 (42)
Hot water usage for mixer showers	85.2743	83.9928	82.1254	78.5525	75.9157	72.9753	71.3039	73.1572	75.1887	78.3459	81.9956	84.9476	(42a)
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023	(42b)
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168	(42c)
Average daily hot water use (litres/day)												137.7493	(43)
Daily hot water use	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667	(44)
Energy conte	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722	(45)
Energy content (annual)										Total = Sum(45)m =		2288.0299	
Distribution loss (46)m = 0.15 x (45)m	35.5832	31.3419	32.9526	28.1229	26.6898	23.4250	22.6529	23.8945	24.5374	28.1114	30.8121	35.0808	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311	(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	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311	(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	91.6158	80.9814	85.7846	74.6679	71.9021	64.2542	62.9536	65.7059	66.7201	75.0533	80.6289	90.5022	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)

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

Metabolic gains (Table 5), Watts													
(66)m	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0695	19.6019	15.9414	12.0686	9.0215	7.6163	8.2297	10.6972	14.3578	18.2305	21.2777	22.6829	(67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	123.1395	120.5080	115.3019	103.7054	96.6426	89.2420	84.6150	88.3144	92.6668	100.8780	111.9845	121.6428 (72)
Total internal gains	539.7322	537.7011	521.1032	489.1752	458.2888	426.9562	409.8975	412.9965	428.7406	460.2835	495.2135	525.8037 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East						7.5100	19.6403		0.6300	0.7000	0.7700	45.0774 (76)	
South						1.8900	46.7521		0.6300	0.7000	0.7700	27.0044 (78)	
West						11.9500	19.6403		0.6300	0.7000	0.7700	71.7277 (80)	
East						3.1200	26.0000		0.6300	0.7000	1.0000	32.1965 (82)	
West						7.1100	26.0000		0.6300	0.7000	1.0000	73.3709 (82)	
Solar gains	249.3770	491.9774	822.4237	1221.5262	1518.5139	1564.4245	1485.2760	1261.1120	963.4352	586.8104	311.6412	204.6552 (83)	
Total gains	789.1092	1029.6784	1343.5269	1710.7013	1976.8027	1991.3807	1895.1735	1674.1084	1392.1758	1047.0939	806.8547	730.4589 (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	56.9161	57.0963	57.2777	58.2023	58.3908	59.3520	59.3520	59.5480	58.9637	58.3908	58.0150	57.6440
alpha	4.7944	4.8064	4.8185	4.8802	4.8927	4.9568	4.9568	4.9699	4.9309	4.8927	4.8677	4.8429
util living area	0.9893	0.9654	0.8836	0.6926	0.4881	0.3326	0.2408	0.2839	0.5079	0.8491	0.9753	0.9923 (86)
MIT	20.0165	20.2701	20.6020	20.8503	20.9220	20.9358	20.9372	20.9371	20.9247	20.7494	20.3172	19.9754 (87)
Th 2	19.6585	19.6621	19.6657	19.6839	19.6875	19.7058	19.7058	19.7095	19.6985	19.6875	19.6803	19.6730 (88)
util rest of house	0.9850	0.9528	0.8492	0.6333	0.4225	0.2659	0.1701	0.2045	0.4168	0.7918	0.9641	0.9892 (89)
MIT 2	18.5593	18.8766	19.2669	19.5354	19.5976	19.6250	19.6256	19.6294	19.6124	19.4565	18.9552	18.5189 (90)
Living area fraction	fLA = Living area / (4) = 0.3455 (91)											
MIT	19.0627	19.3580	19.7281	19.9897	20.0552	20.0778	20.0787	20.0811	20.0658	19.9032	19.4257	19.0221 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.9127	19.2080	19.5781	19.8397	19.9052	19.9278	19.9287	19.9311	19.9158	19.7532	19.2757	18.8721 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9818	0.9475	0.8466	0.6407	0.4336	0.2774	0.1823	0.2181	0.4323	0.7950	0.9596	0.9866 (94)
Ext temp.	774.7536	975.5761	1137.3940	1095.9948	857.0720	552.3206	345.4531	365.1719	601.8545	832.4918	774.2481	720.6959 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1581.6904	1543.8173	1406.6429	1157.9491	865.7021	553.0183	345.5143	365.3199	607.6407	965.7209	1292.9446	1568.0576 (97)
Space heating requirement - total per year (kWh/year)	600.3609	381.8581	200.3212	44.6071	6.4208	0.0000	0.0000	0.0000	0.0000	99.1225	373.4615	630.4371 (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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	600.3609	381.8581	200.3212	44.6071	6.4208	0.0000	0.0000	0.0000	0.0000	99.1225	373.4615	630.4371 (98c)
Space heating per m2	(98c) / (4) = 2336.5892 33.2185 (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 %)	88.9000 (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)	600.3609	381.8581	200.3212	44.6071	6.4208	0.0000	0.0000	0.0000	0.0000	99.1225	373.4615	630.4371 (98)
Space heating fuel (main heating system)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000 (210)
Space heating efficiency (main heating system 2)	675.3216	429.5367	225.3332	50.1767	7.2225	0.0000	0.0000	0.0000	0.0000	111.4988	420.0917	709.1530 (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)
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	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311 (64)
Efficiency of water heater (217)m	85.9157	85.2447	83.7459	81.5505	80.5125	80.3000	80.3000	80.3000	80.3000	82.6482	85.1999	80.3000 (216)
Fuel for water heating, kWh/month	276.1093	245.1131	262.3221	229.9018	220.9991	194.4792	188.0686	198.3770	203.7146	226.7552	241.0962	271.8413 (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)

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Pumps and Fa	83.2822	75.2226	83.2822	80.5957	83.2822	80.5957	83.2822	83.2822	80.5957	83.2822	80.5957	83.2822	(231)
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542	(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												2628.3343	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2758.7776	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4280)													
mechanical ventilation fans (SFP = 1.4280)												339.5808	(230a)
central heating pump												41.0000	(230c)
maintaining electric keep-hot facility for gas combi boiler												600.0000	(230f)
Total electricity for the above, kWh/year												980.5808	(231)
Electricity for lighting (calculated in Appendix L)												155.9017	(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												6523.5944	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2628.3343	3.6400	95.6714	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2758.7776	3.6400	100.4195	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	980.5808	16.4900	161.6978	(249)
Energy for lighting	155.9017	16.4900	25.7082	(250)
Additional standing charges			92.0000	(251)
Total energy cost			475.4968	(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] =	1.4841	(257)
SAP value		75.9423	
SAP rating (Section 12)		76	(258)
SAP band		C	

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

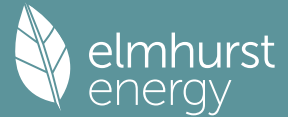
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2628.3343	0.2100	551.9502	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2758.7776	0.2100	579.3433	(264)
Space and water heating			1131.2935	(265)
Pumps, fans and electric keep-hot	980.5808	0.1387	136.0186	(267)
Energy for lighting	155.9017	0.1443	22.5014	(268)
Total CO2, kg/year			1289.8136	(272)
CO2 emissions per m2			18.3400	(273)
EI value			85.0152	
EI rating			85	(274)
EI band			B	

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)
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Ground floor	53.2400 (1b)	x	2.8100 (2b)	=	149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x	2.6500 (2c)	=	45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.9194 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000 (17)		
Infiltration rate	0.2500 (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) =	0.2125 (21)	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.6000	4.3000	4.4000	4.0000	4.0000	3.5000	3.6000	3.8000	3.7000	3.9000	3.9000	4.3000 (22)
Adj infilt rate	1.1500	1.0750	1.1000	1.0000	1.0000	0.8750	0.9000	0.9500	0.9250	0.9750	0.9750	1.0750 (22a)
	0.2444	0.2284	0.2338	0.2125	0.2125	0.1859	0.1913	0.2019	0.1966	0.2072	0.2072	0.2284 (22b)
Balanced mechanical ventilation with heat recovery												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)												83.7000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3259	0.3099	0.3152	0.2940	0.2940	0.2674	0.2727	0.2834	0.2781	0.2887	0.2887	0.3099 (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
Windows (Uw = 1.20)			21.3500	1.1450	24.4466		(27)
RL1			2.0900	1.1450	2.3931		(27a)
RL2			1.0300	1.1450	1.1794		(27a)
RL3			7.1100	1.1450	8.1412		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000 (28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680 (29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800 (30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200 (30)
Total net area of external elements Aum(A, m2)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7871		(33)
Internal Wall 1			90.0000			9.0000	810.0000 (32c)
Internal Floor 1			17.1000			18.0000	307.8000 (32d)
Internal Ceiling 1			17.1000			9.0000	153.9000 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	22178.2680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		315.3009 (35)

List of Thermal Bridges

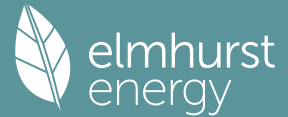
	Length	Psi-value	Total
K1 Element	11.5400	0.0638	0.7363
E2 Other lintels (including other steel lintels)	10.6400	0.0200	0.2128
E3 Sill	22.0500	0.0150	0.3307
E4 Jamb	37.7800	0.0510	1.9268
E5 Ground floor (normal)	17.9800	0.0010	0.0180
E6 Intermediate floor within a dwelling	32.9200	0.0380	1.2510
E16 Corner (normal)	24.8100	0.2400	5.9544
R11 Upstands or kerbs of rooflights	11.0800	-0.0740	-0.8199
E17 Corner (inverted - internal area greater than external area)	37.7800	0.0840	3.1735
E15 Flat roof with parapet			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.7835 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 85.5706 (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
	20.9614	19.9362	20.2780	18.9111	18.9111	17.2025	17.5442	18.2276	17.8859	18.5694	18.5694	19.9362 (38)
Heat transfer coeff	106.5320	105.5068	105.8486	104.4817	104.4817	102.7731	103.1148	103.7983	103.4565	104.1400	104.1400	105.5068 (39)
Average = Sum(39)m / 12 =												104.4817
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5145	1.5000	1.5048	1.4854	1.4854	1.4611	1.4659	1.4757	1.4708	1.4805	1.4805	1.5000 (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	2.2544 (42)											
Hot water usage for mixer showers	85.2743	83.9928	82.1254	78.5525	75.9157	72.9753	71.3039	73.1572	75.1887	78.3459	81.9956	84.9476 (42a)
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023 (42b)
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168 (42c)
Average daily hot water use (litres/day)												137.7493 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667	(44)
Energy conte	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722	(45)
Energy content (annual)	Total = Sum(45)m = 2288.0299												
Distribution loss (46)m = 0.15 x (45)m	35.5832	31.3419	32.9526	28.1229	26.6898	23.4250	22.6529	23.8945	24.5374	28.1114	30.8121	35.0808	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311	(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	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311	(64)
Total per year (kWh/year) = Sum(64)m = 2888.0299												(64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000												(64a)	
Heat gains from water heating, kWh/month	91.6158	80.9814	85.7846	74.6679	71.9021	64.2542	62.9536	65.7059	66.7201	75.0533	80.6289	90.5022	(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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0695	19.6019	15.9414	12.0686	9.0215	7.6163	8.2297	10.6972	14.3578	18.2305	21.2777	22.6829	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	123.1395	120.5080	115.3019	103.7054	96.6426	89.2420	84.6150	88.3144	92.6668	100.8780	111.9845	121.6428	(72)
Total internal gains	539.7322	537.7011	521.1032	489.1752	458.2888	426.9562	409.8975	412.9965	428.7406	460.2835	495.2135	525.8037	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					7.5100	21.5869	0.6300	0.7000	0.7700		49.5453 (76)	
South					1.8900	49.2853	0.6300	0.7000	0.7700		28.4676 (78)	
West					11.9500	21.5869	0.6300	0.7000	0.7700		78.8371 (80)	
East					3.1200	29.0000	0.6300	0.7000	1.0000		35.9115 (82)	
West					7.1100	29.0000	0.6300	0.7000	1.0000		81.8368 (82)	
Solar gains	274.5984	486.3446	814.7920	1253.5793	1502.9199	1658.9484	1580.0687	1373.2057	1055.1380	633.3243	354.4043	230.8264 (83)
Total gains	814.3306	1024.0456	1335.8952	1742.7545	1961.2087	2085.9046	1989.9663	1786.2021	1483.8786	1093.6078	849.6177	756.6301 (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	57.8289	58.3908	58.2023	58.9637	58.9637	59.9440	59.7453	59.3520	59.5480	59.1572	59.1572	58.3908	
alpha	4.8553	4.8927	4.8802	4.9309	4.9309	4.9963	4.9830	4.9568	4.9699	4.9438	4.9438	4.8927	
util living area	0.9838	0.9567	0.8480	0.6137	0.4021	0.2265	0.1295	0.1569	0.3747	0.7564	0.9568	0.9878	(86)
MIT	20.1633	20.3752	20.6988	20.8936	20.9322	20.9378	20.9378	20.9375	20.9352	20.8474	20.4774	20.1282	(87)
Th 2	19.6766	19.6875	19.6839	19.6985	19.6985	19.7168	19.7131	19.7058	19.7095	19.7021	19.7021	19.6875	(88)
util rest of house	0.9770	0.9406	0.8040	0.5484	0.3345	0.1634	0.0629	0.0817	0.2861	0.6765	0.9370	0.9826	(89)
MIT 2	18.7591	19.0267	19.3904	19.5876	19.6156	19.6372	19.6334	19.6256	19.6288	19.5617	19.1687	18.7242	(90)
Living area fraction	FLA = Living area / (4) = 0.3455												(91)
MIT	19.2442	19.4926	19.8424	20.0387	20.0704	20.0865	20.0840	20.0788	20.0801	20.0059	19.6208	19.2093	(92)
Temperature adjustment	-0.1500												
adjusted MIT	19.0942	19.3426	19.6924	19.8887	19.9204	19.9365	19.9340	19.9288	19.9301	19.8559	19.4708	19.0593	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9731	0.9354	0.8044	0.5583	0.3461	0.1742	0.0743	0.0947	0.3013	0.6869	0.9326	0.9792	(94)
Useful gains	792.3955	957.8992	1074.5383	972.9840	678.8414	363.4109	147.8681	169.0681	447.1649	751.1642	792.3133	740.9150	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.5000	18.3000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1458.8690	1428.8326	1258.7965	1001.8487	681.2652	363.4594	147.8684	169.0694	447.9787	807.6980	1163.3275	1441.1447	(97)
Space heating kWh	495.8563	316.4673	137.0881	20.7826	1.8033	0.0000	0.0000	0.0000	0.0000	42.0612	267.1302	520.9709	(98a)
Space heating requirement - total per year (kWh/year)	1802.1599												
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

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Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh	495.8563	316.4673	137.0881	20.7826	1.8033	0.0000	0.0000	0.0000	0.0000	42.0612	267.1302	520.9709	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1802.1599	
Space heating per m2										(98c) / (4) =		25.6207	(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 %)													88.9000	(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	495.8563	316.4673	137.0881	20.7826	1.8033	0.0000	0.0000	0.0000	0.0000	42.0612	267.1302	520.9709	(98)	
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)	
Space heating fuel (main heating system)	557.7686	355.9812	154.2049	23.3775	2.0284	0.0000	0.0000	0.0000	0.0000	47.3129	300.4839	586.0190	(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	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311	(64)	
Efficiency of water heater	85.5330	84.8455	82.9996	80.9317	80.3608	80.3000	80.3000	80.3000	80.3000	81.4823	84.4835	85.6573	(216)	
Fuel for water heating, kWh/month	277.3448	246.2663	264.6807	231.6598	221.4165	194.4792	188.0686	198.3770	203.7146	229.9999	243.1408	273.0324	(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	83.2822	75.2226	83.2822	80.5957	83.2822	80.5957	83.2822	83.2822	80.5957	83.2822	80.5957	83.2822	(231)	
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													2027.1764	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													80.3000	
Water heating fuel used													2772.1806	(219)
Space cooling fuel													0.0000	(221)

Electricity for pumps and fans:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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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												5935.8396	(238)

10a. Fuel costs - using BEDF prices (542)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2027.1764	6.1900	125.4822	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2772.1806	6.1900	171.5980	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	980.5808	25.1600	246.7141	(249)
Energy for lighting	155.9017	25.1600	39.2249	(250)
Additional standing charges			102.0000	(251)
Total energy cost			685.0192	(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	2027.1764	0.2100	425.7071	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2772.1806	0.2100	582.1579	(264)

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Space and water heating			1007.8650 (265)
Pumps, fans and electric keep-hot	980.5808	0.1387	136.0186 (267)
Energy for lighting	155.9017	0.1443	22.5014 (268)
Total CO ₂ , kg/year			1166.3851 (272)

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	2027.1764	1.1300	2290.7094 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	2772.1806	1.1300	3132.5641 (278)
Space and water heating			5423.2735 (279)
Pumps, fans and electric keep-hot	980.5808	1.5128	1483.4226 (281)
Energy for lighting	155.9017	1.5338	239.1273 (282)
Total Primary energy kWh/year			7145.8234 (286)

SAP 10 EPC IMPROVEMENTS

Be Lean

Current energy efficiency rating: C 76
Current environmental impact rating: B 85

N Solar water heating			SAP increase too small
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO ₂ change
U Solar photovoltaic panels	+ 9.3	-£ 263	-232 kg (19.9%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 33	-168 kg (14.4%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£263	3.30 kg/m ²	B 85 B 88
Total Savings	£263	3.30 kg/m ²	
Potential energy efficiency rating:		B 85	
Potential environmental impact rating:			B 88

Fuel prices for cost data on this page from database revision number 542 TEST (30 Apr 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£286	£286	£0
Mains gas	£399	£399	£0
Space heating	£474	£474	£0
Water heating	£172	£172	£0
Lighting	£39	£39	£0
Generated (PV)	-£0	-£263	£263
Total cost of fuels	£685	£422	£263
Total cost of uses	£685	£422	£263
Delivered energy	84 kWh/m ²	59 kWh/m ²	26 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.2 tonnes
CO ₂ emissions per m ²	17 kg/m ²	13 kg/m ²	3 kg/m ²
Primary energy	102 kWh/m ²	78 kWh/m ²	24 kWh/m ²

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

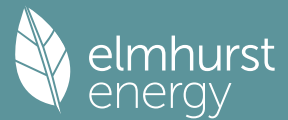
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (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)

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Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
0 * 10 = 0.0000 (7a)
0 * 10 = 0.0000 (7b)
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
Blower Door
Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.2125 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
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												
	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497

Balanced mechanical ventilation with heat recovery
If mechanical ventilation
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

Effective ac	0.3524	0.3471	0.3418	0.3152	0.3099	0.2834	0.2834	0.2781	0.2940	0.3099	0.3206	0.3312
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(22)
(22a)
(22b)
(23a)
(23b)
(23c)
(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
Windows (Uw = 1.20)			21.3500	1.1450	24.4466		
RL1			2.0900	1.1450	2.3931		
RL2			1.0300	1.1450	1.1794		
RL3			7.1100	1.1450	8.1412		
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200
Total net area of external elements Aum(A, m2)			270.5788				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.7871		
Internal Wall 1			90.0000			9.0000	810.0000
Internal Floor 1			17.1000			18.0000	307.8000
Internal Ceiling 1			17.1000			9.0000	153.9000

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

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.5400	0.0638	0.7363
E3 Sill	10.6400	0.0200	0.2128
E4 Jamb	22.0500	0.0150	0.3307
E5 Ground floor (normal)	37.7800	0.0510	1.9268
E6 Intermediate floor within a dwelling	17.9800	0.0010	0.0180
E16 Corner (normal)	32.9200	0.0380	1.2510
R11 Upstands or kerbs of rooflights	24.8100	0.2400	5.9544
E17 Corner (inverted - internal area greater than external area)	11.0800	-0.0740	-0.8199
E15 Flat roof with parapet	37.7800	0.0840	3.1735

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal Bridges
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 22178.2680 (34)
315.3009 (35)
(33) + (36) + (36a) = 85.5706 (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
	22.6700	22.3283	21.9865	20.2780	19.9362	18.2276	18.2276	17.8859	18.9111	19.9362	20.6197	21.3031

Heat transfer coeff
Average = Sum(39)m / 12 =

	108.2406	107.8989	107.5572	105.8486	105.5068	103.7983	103.7983	103.4565	104.4817	105.5068	106.1903	106.8737
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105.7631 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.5388	1.5340	1.5291	1.5048	1.5000	1.4757	1.4757	1.4708	1.4854	1.5000	1.5097	1.5194

HLP (average)
Days in mont

	31	28	31	30	31	30	31	31	30	31	30	31
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1.5036
31 (40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Hot water usage for mixer showers
Hot water usage for baths
Hot water usage for other uses
Average daily hot water use (litres/day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667

Energy conte
Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m
Water storage loss:
Total storage loss
If cylinder contains dedicated solar storage
Primary loss
Combi loss
Total heat required for water heating calculated for each month

	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722
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Total = Sum(45)m = 2288.0299 (44)
(45)
(46)
(56)
(57)
(59)
(61)

Full SAP Calculation Printout



WHRHS	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311 (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	91.6158	80.9814	85.7846	74.6679	71.9021	64.2542	62.9536	65.7059	66.7201	75.0533	80.6289	90.5022 (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	
(66m)	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0695	19.6019	15.9414	12.0686	9.0215	7.6163	8.2297	10.6972	14.3578	18.2305	21.2777	22.6829	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	123.1395	120.5080	115.3019	103.7054	96.6426	89.2420	84.6150	88.3144	92.6668	100.8780	111.9845	121.6428	(72)
Total internal gains	539.7322	537.7011	521.1032	489.1752	458.2888	426.9562	409.8975	412.9965	428.7406	460.2835	495.2135	525.8037	(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	
East					7.5100	19.6403		0.6300	0.7000	0.7700		45.0774 (76)	
South					1.8900	46.7521		0.6300	0.7000	0.7700		27.0044 (78)	
West					11.9500	19.6403		0.6300	0.7000	0.7700		71.7277 (80)	
East					3.1200	26.0000		0.6300	0.7000	1.0000		32.1965 (82)	
West					7.1100	26.0000		0.6300	0.7000	1.0000		73.3709 (82)	
Solar gains	249.3770	491.9774	822.4237	1221.5262	1518.5139	1564.4245	1485.2760	1261.1120	963.4352	586.8104	311.6412	204.6552 (83)	
Total gains	789.1092	1029.6784	1343.5269	1710.7013	1976.8027	1991.3807	1895.1735	1674.1084	1392.1758	1047.0939	806.8547	730.4589 (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	56.9161	57.0963	57.2777	58.2023	58.3908	59.3520	59.3520	59.5480	58.9637	58.3908	58.0150	57.6440	
alpha	4.7944	4.8064	4.8185	4.8802	4.8927	4.9568	4.9568	4.9699	4.9309	4.8927	4.8677	4.8429	
util living area	0.9893	0.9654	0.8836	0.6926	0.4881	0.3326	0.2408	0.2839	0.5079	0.8491	0.9753	0.9923	(86)
MIT	20.0165	20.2701	20.6020	20.8503	20.9220	20.9358	20.9372	20.9371	20.9247	20.7494	20.3172	19.9754	(87)
Th 2	19.6585	19.6621	19.6657	19.6839	19.6875	19.7058	19.7058	19.7095	19.6985	19.6875	19.6803	19.6730	(88)
util rest of house	0.9850	0.9528	0.8492	0.6333	0.4225	0.2659	0.1701	0.2045	0.4168	0.7918	0.9641	0.9892	(89)
MIT 2	18.5593	18.8766	19.2669	19.5354	19.5976	19.6250	19.6256	19.6294	19.6124	19.4565	18.9552	18.5189	(90)
Living area fraction									fLA = Living area / (4) =			0.3455	(91)
MIT	19.0627	19.3580	19.7281	19.9897	20.0552	20.0778	20.0787	20.0811	20.0658	19.9032	19.4257	19.0221	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9127	19.2080	19.5781	19.8397	19.9052	19.9278	19.9287	19.9311	19.9158	19.7532	19.2757	18.8721	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9818	0.9475	0.8466	0.6407	0.4336	0.2774	0.1823	0.2181	0.4323	0.7950	0.9596	0.9866	(94)
Useful gains	774.7536	975.5761	1137.3940	1095.9948	857.0720	552.3206	345.4531	365.1719	601.8545	832.4918	774.2481	720.6959	(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	1581.6904	1543.8173	1406.6429	1157.9491	865.7021	553.0183	345.5143	365.3199	607.6407	965.7209	1292.9446	1568.0576	(97)
Space heating kWh	600.3609	381.8581	200.3212	44.6071	6.4208	0.0000	0.0000	0.0000	0.0000	99.1225	373.4615	630.4371	(98a)
Space heating requirement - total per year (kWh/year)												2336.5892	
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	600.3609	381.8581	200.3212	44.6071	6.4208	0.0000	0.0000	0.0000	0.0000	99.1225	373.4615	630.4371	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2336.5892	
Space heating per m2										(98c) / (4) =		33.2185	(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 %)	88.9000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	600.3609	381.8581	200.3212	44.6071	6.4208	0.0000	0.0000	0.0000	0.0000	99.1225	373.4615	630.4371	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	675.3216	429.5367	225.3332	50.1767	7.2225	0.0000	0.0000	0.0000	0.0000	111.4988	420.0917	709.1530	(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	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311	(64)
Efficiency of water heater	85.9157	85.2447	83.7459	81.5505	80.5125	80.3000	80.3000	80.3000	80.3000	82.6482	85.1999	86.0326	(216)
Fuel for water heating, kWh/month	276.1093	245.1131	262.3221	229.9018	220.9991	194.4792	188.0686	198.3770	203.7146	226.7552	241.0962	271.8413	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
(221)m	83.2822	75.2226	83.2822	80.5957	83.2822	80.5957	83.2822	83.2822	80.5957	83.2822	80.5957	83.2822	(221)
Pumps and Fa	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542	(232)
Lighting	-34.0394	-49.2725	-73.0167	-85.0216	-94.6202	-89.9723	-89.3392	-83.0859	-72.1206	-58.0763	-38.0492	-29.3128	(233a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
(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	(234a)
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)
(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	(235a)
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)
(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	(235c)
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)
(235c)m	-16.0471	-34.3075	-69.3296	-105.7504	-141.0626	-141.7415	-139.3123	-116.6881	-84.3425	-48.7696	-21.3606	-12.6011	(233b)
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)
(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	(234b)
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)
(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	(235b)
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)
(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	(235d)
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)
(235d)m													
Annual totals kWh/year													
Space heating fuel - main system 1												2628.3343	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	(216)
Water heating fuel used												2758.7776	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4280)													
mechanical ventilation fans (SFP = 1.4280)												339.5808	(230a)
central heating pump												41.0000	(230c)
maintaining electric keep-hot facility for gas combi boiler												600.0000	(230f)
Total electricity for the above, kWh/year												980.5808	(231)
Electricity for lighting (calculated in Appendix L)												155.9017	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4796.3550	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2628.3343	3.6400	95.6714	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2758.7776	3.6400	100.4195	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	980.5808	16.4900	161.6978	(249)
Energy for lighting	155.9017	16.4900	25.7082	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-795.9266	16.4900	-131.2483	
PV Unit electricity exported	-931.3128	5.5900	-52.0604	
Total			-183.3087	(252)
Total energy cost			292.1882	(255)

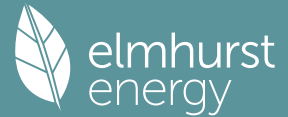
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9120	(257)
SAP value		85.2168	
SAP rating (Section 12)		85	(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	2628.3343	0.2100	551.9502	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2758.7776	0.2100	579.3433	(264)

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Space and water heating			1131.2935 (265)
Pumps, fans and electric keep-hot	980.5808	0.1387	136.0186 (267)
Energy for lighting	155.9017	0.1443	22.5014 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-795.9266	0.1338	-106.4910
PV Unit electricity exported	-931.3128	0.1256	-116.9668
Total			-223.4577 (269)
Total CO ₂ , kg/year			1066.3558 (272)
CO ₂ emissions per m ²			15.1600 (273)
EI value			87.6113
EI rating			88 (274)
EI band			B

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)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (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		5.0000 (17)
Infiltration rate		0.2500 (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) =	0.2125 (21)

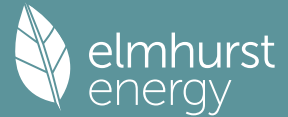
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.3000	4.4000	4.0000	4.0000	3.5000	3.6000	3.8000	3.7000	3.9000	3.9000	4.3000 (22)
Wind factor	1.1500	1.0750	1.1000	1.0000	1.0000	0.8750	0.9000	0.9500	0.9250	0.9750	0.9750	1.0750 (22a)
Adj infilt rate	0.2444	0.2284	0.2338	0.2125	0.2125	0.1859	0.1913	0.2019	0.1966	0.2072	0.2072	0.2284 (22b)
Balanced mechanical ventilation with heat recovery												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)												83.7000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3259	0.3099	0.3152	0.2940	0.2940	0.2674	0.2727	0.2834	0.2781	0.2887	0.2887	0.3099 (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
Windows (U _w = 1.20)			21.3500	1.1450	24.4466		(27)
RL1			2.0900	1.1450	2.3931		(27a)
RL2			1.0300	1.1450	1.1794		(27a)
RL3			7.1100	1.1450	8.1412		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000 (28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680 (29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800 (30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200 (30)
Total net area of external elements A _{um} (A, m ²)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.7871		(33)
Internal Wall 1			90.0000			9.0000	810.0000 (32c)
Internal Floor 1			17.1000			18.0000	307.8000 (32d)
Internal Ceiling 1			17.1000			9.0000	153.9000 (32e)
Heat capacity C _m = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22178.2680 (34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							315.3009 (35)

List of Thermal Bridges		
K1 Element	Length	Psi-value
E2 Other lintels (including other steel lintels)	11.5400	0.0638
E3 Sill	10.6400	0.0200
E4 Jamb	22.0500	0.0150
E5 Ground floor (normal)	37.7800	0.0510
E6 Intermediate floor within a dwelling	17.9800	0.0010
		Total
		0.7363
		0.2128
		0.3307
		1.9268
		0.0180

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E16 Corner (normal)	32.9200	0.0380	1.2510
R11 Upstands or kerbs of rooflights	24.8100	0.2400	5.9544
E17 Corner (inverted - internal area greater than external area)	11.0800	-0.0740	-0.8199
E15 Flat roof with parapet	37.7800	0.0840	3.1735
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.7835 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	85.5706 (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	20.9614	19.9362	20.2780	18.9111	18.9111	17.2025	17.5442	18.2276	17.8859	18.5694	18.5694	19.9362 (38)
Average = Sum(39)m / 12 =	106.5320	105.5068	105.8486	104.4817	104.4817	102.7731	103.1148	103.7983	103.4565	104.1400	104.1400	105.5068 (39)
												104.4817
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5145	1.5000	1.5048	1.4854	1.4854	1.4611	1.4659	1.4757	1.4708	1.4805	1.4805	1.5000 (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												2.2544 (42)
Hot water usage for mixer showers												84.9476 (42a)
Hot water usage for baths												26.7023 (42b)
Hot water usage for other uses												37.7168 (42c)
Average daily hot water use (litres/day)												137.7493 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667 (44)
Energy content (annual)	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722 (45)
Distribution loss (46)m = 0.15 x (45)m												2288.0299
Water storage loss:												
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
WWHRS	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311 (64)
Electric shower(s)												
Heat gains from water heating, kWh/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 (64a)
	91.6158	80.9814	85.7846	74.6679	71.9021	64.2542	62.9536	65.7059	66.7201	75.0533	80.6289	90.5022 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)												
Total per year (kWh/year) = Sum(64)m = 2888.0299 (64)												

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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.0695	19.6019	15.9414	12.0686	9.0215	7.6163	8.2297	10.6972	14.3578	18.2305	21.2777	22.6829 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)
Pumps, fans	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Total internal gains	123.1395	120.5080	115.3019	103.7054	96.6426	89.2420	84.6150	88.3144	92.6668	100.8780	111.9845	121.6428 (72)
	539.7322	537.7011	521.1032	489.1752	458.2888	426.9562	409.8975	412.9965	428.7406	460.2835	495.2135	525.8037 (73)

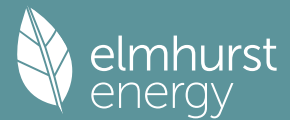
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				7.5100	21.5869		0.6300		0.7000		0.7700		49.5453 (76)
South				1.8900	49.2853		0.6300		0.7000		0.7700		28.4676 (78)
West				11.9500	21.5869		0.6300		0.7000		0.7700		78.8371 (80)
East				3.1200	29.0000		0.6300		0.7000		1.0000		35.9115 (82)
West				7.1100	29.0000		0.6300		0.7000		1.0000		81.8368 (82)
Solar gains	274.5984	486.3446	814.7920	1253.5793	1502.9199	1658.9484	1580.0687	1373.2057	1055.1380	633.3243	354.4043	230.8264	(83)
Total gains	814.3306	1024.0456	1335.8952	1742.7545	1961.2087	2085.9046	1989.9663	1786.2021	1483.8786	1093.6078	849.6177	756.6301	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	57.8289	58.3908	58.2023	58.9637	58.9637	59.9440	59.7453	59.3520	59.5480	59.1572	59.1572	58.3908	
alpha	4.8553	4.8927	4.8802	4.9309	4.9309	4.9963	4.9830	4.9568	4.9699	4.9438	4.9438	4.8927	
util living area	0.9838	0.9567	0.8480	0.6137	0.4021	0.2265	0.1295	0.1569	0.3747	0.7564	0.9568	0.9878	(86)
MIT	20.1633	20.3752	20.6988	20.8936	20.9322	20.9378	20.9378	20.9375	20.9352	20.8474	20.4774	20.1282	(87)
Th 2	19.6766	19.6875	19.6839	19.6985	19.6985	19.7168	19.7131	19.7058	19.7095	19.7021	19.7021	19.6875	(88)
util rest of house	0.9770	0.9406	0.8040	0.5484	0.3345	0.1634	0.0629	0.0817	0.2861	0.6765	0.9370	0.9826	(89)
MIT 2	18.7591	19.0267	19.3904	19.5876	19.6156	19.6372	19.6334	19.6256	19.6288	19.5617	19.1687	18.7242	(90)
Living area fraction													
MIT	19.2442	19.4926	19.8424	20.0387	20.0704	20.0865	20.0840	20.0788	20.0801	20.0059	19.6208	19.2093	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0942	19.3426	19.6924	19.8887	19.9204	19.9365	19.9340	19.9288	19.9301	19.8559	19.4708	19.0593	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9731	0.9354	0.8044	0.5583	0.3461	0.1742	0.0743	0.0947	0.3013	0.6869	0.9326	0.9792	(94)
Useful gains	792.3955	957.8992	1074.5383	972.9840	678.8414	363.4109	147.8681	169.0681	447.1649	751.1642	792.3133	740.9150	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.5000	18.3000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1458.8690	1428.8326	1258.7965	1001.8487	681.2652	363.4594	147.8684	169.0694	447.9787	807.6980	1163.3275	1441.1447	(97)
Space heating kWh	495.8563	316.4673	137.0881	20.7826	1.8033	0.0000	0.0000	0.0000	0.0000	42.0612	267.1302	520.9709	(98a)
Space heating requirement - total per year (kWh/year)												1802.1599	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	495.8563	316.4673	137.0881	20.7826	1.8033	0.0000	0.0000	0.0000	0.0000	42.0612	267.1302	520.9709	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1802.1599	
Space heating per m2										(98c) / (4) =		25.6207	(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 %)													88.9000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	495.8563	316.4673	137.0881	20.7826	1.8033	0.0000	0.0000	0.0000	0.0000	42.0612	267.1302	520.9709	(98)	
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)	
Space heating fuel (main heating system)	557.7686	355.9812	154.2049	23.3775	2.0284	0.0000	0.0000	0.0000	0.0000	47.3129	300.4839	586.0190	(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	288.1802	254.9733	270.6428	236.8012	228.8909	205.4819	201.9780	210.2556	212.8979	238.3680	254.7289	284.8311	(64)	
Efficiency of water heater (217)m	85.5330	84.8455	82.9996	80.9317	80.3608	80.3000	80.3000	80.3000	80.3000	81.4823	84.4835	85.6573	(216)	
Fuel for water heating, kWh/month	277.3448	246.2663	264.6807	231.6598	221.4165	194.4792	188.0686	198.3770	203.7146	229.9999	243.1408	273.0324	(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	83.2822	75.2226	83.2822	80.5957	83.2822	80.5957	83.2822	83.2822	80.5957	83.2822	80.5957	83.2822	(231)	
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-36.2940	-48.3176	-71.9531	-85.8482	-93.7698	-92.4549	-91.9442	-86.6335	-75.6154	-60.5810	-41.4784	-31.9025	(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	-17.9812	-33.0569	-67.2672	-108.1036	-137.9740	-151.9633	-149.8877	-129.1385	-93.7745	-53.0733	-25.0195	-14.6155	(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												2027.1764	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												80.3000		
Water heating fuel used												2772.1806	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4280)														
mechanical ventilation fans (SFP = 1.4280)													339.5808	(230a)
central heating pump													41.0000	(230c)
maintaining electric keep-hot facility for gas combi boiler													600.0000	(230f)
Total electricity for the above, kWh/year													980.5808	(231)
Electricity for lighting (calculated in Appendix L)													155.9017	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1798.6477	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)

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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	4137.1919 (238)

10a. Fuel costs - using BEDF prices (542)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2027.1764	6.1900	125.4822 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2772.1806	6.1900	171.5980 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	980.5808	25.1600	246.7141 (249)
Energy for lighting	155.9017	25.1600	39.2249 (250)
Additional standing charges			102.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-816.7926	25.1600	-205.5050
PV Unit electricity exported	-981.8551	5.8100	-57.0458
Total			-262.5508 (252)
Total energy cost			422.4684 (255)

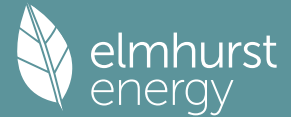
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2027.1764	0.2100	425.7071 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2772.1806	0.2100	582.1579 (264)
Space and water heating			1007.8650 (265)
Pumps, fans and electric keep-hot	980.5808	0.1387	136.0186 (267)
Energy for lighting	155.9017	0.1443	22.5014 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-816.7926	0.1337	-109.2403
PV Unit electricity exported	-981.8551	0.1248	-122.5699
Total			-231.8101 (269)
Total CO2, kg/year			934.5749 (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	2027.1764	1.1300	2290.7094 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2772.1806	1.1300	3132.5641 (278)
Space and water heating			5423.2735 (279)
Pumps, fans and electric keep-hot	980.5808	1.5128	1483.4226 (281)
Energy for lighting	155.9017	1.5338	239.1273 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-816.7926	1.4942	-1220.4763
PV Unit electricity exported	-981.8551	0.4581	-449.7844
Total			-1670.2607 (283)
Total Primary energy kWh/year			5475.5627 (286)

Predicted Energy Assessment



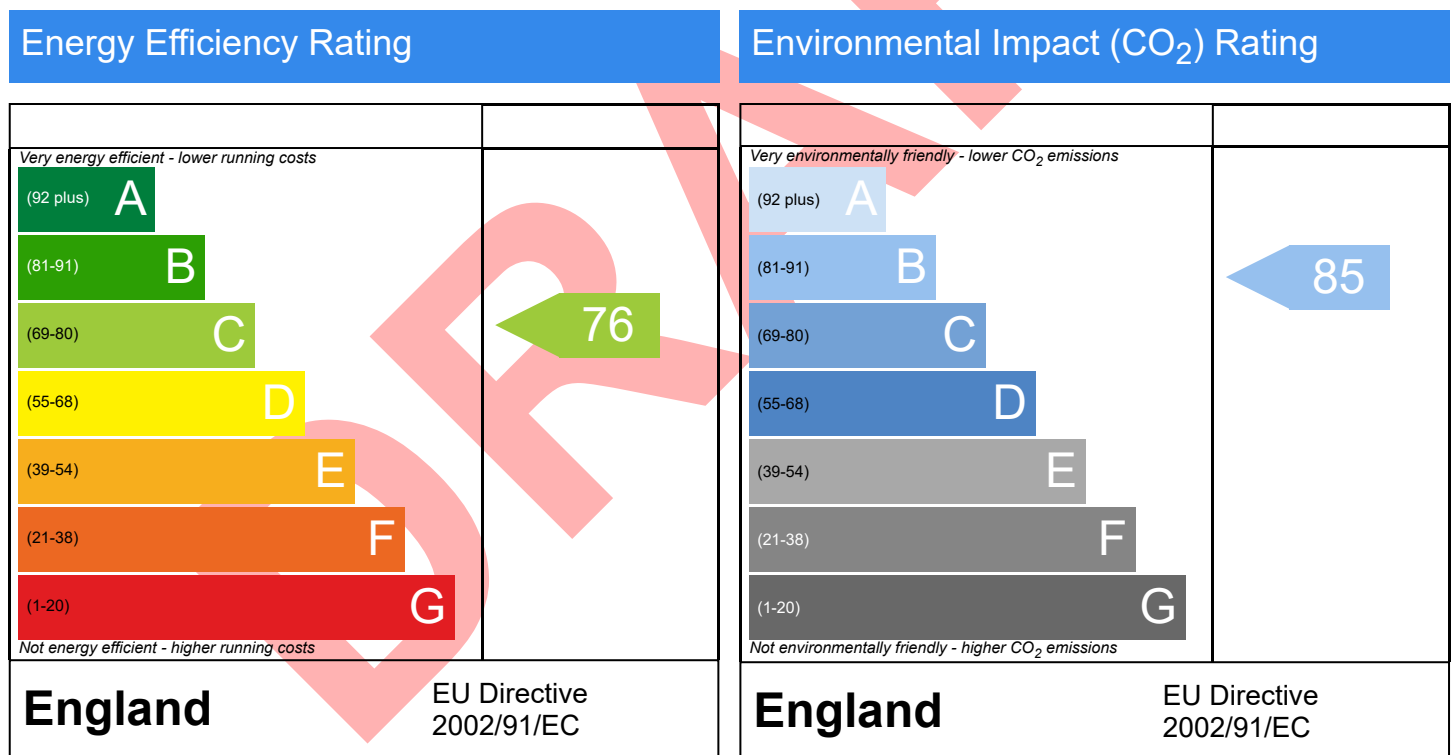
46, Priory Road, Hornsey, London, N8 7EX

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Detached
16/05/2024
Darren Coham
70.34 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.



Appendix B - Be Green Stage SAP 2021 Calculation Sheets and Predicted Energy Assessment

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Thu 16 May 2024 08:40:15

Project Information			
Assessed By	Darren Coham	Building Type	House, Detached
OCDEA Registration	EES/022007	Assessment Date	2024-05-16

Dwelling Details			
Assessment Type	As designed	Total Floor Area	70 m ²
Site Reference	46 Priory Road	Plot Reference	Be Green
Address	46 Priory Road, Hornsey, N8 7EX		

Client Details	
Name	District
Company	District Architets
Address	Studio 4, Blackwater Court, 17-19 Blackwater Street, London, SE22 8SD

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	18.38 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	4.09 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	97.45 kWh _{PE} /m ²		
Dwelling primary energy	43.55 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	73.1 kWh/m ²		
Dwelling fabric energy efficiency	57.9 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.13	Heatloss Floor 1 (0.13)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	w1 (1.2)	OK
Rooflights	2.2	1.2	RL1, East (1.2)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	132.4597	0.18
Ground floor: Heatloss Floor 1, Heatloss Floor 1	53.24	0.13
Exposed roof: Roof (1)	50.1195	0.11
Exposed roof: Roof (2)	3.1836	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
w1, Windows	4.6215	West	0.7	1.2
d1, Windows	1.89	South	0.7	1.2
w3, Windows	5.2962	East	0.7	1.2
w4, Windows	2.2116	East	0.7	1.2
fw1, Windows	5.72	West	0.7	1.2
fw2, Windows	1.611	West	0.7	1.2
RL1, Roof Window	2.0945	East	0.7	1.2
RL2, Roof Window	1.026	East	0.7	1.2
RL3, Roof Window	7.1064	West	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))	
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Government-approved scheme	0.0638	
External wall	E3: Sill	Government-approved scheme	0.02 (!)	
External wall	E4: Jamb	Government-approved scheme	0.015 (!)	
External wall	E5: Ground floor (normal)	Government-approved scheme	0.051	
External wall	E6: Intermediate floor within a dwelling	Government-approved scheme	0.001 (!)	
External wall	E16: Corner (normal)	Government-approved scheme	0.038 (!)	
Roof	R11: Upstands or kerbs of rooflights	SAP table default	0.24	
External wall	E17: Corner (inverted - internal area greater than external area)	Government-approved scheme	-0.074	
External wall	E15: Flat roof with parapet	Government-approved scheme	0.084	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	5 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity

Efficiency	272.2%
Emitter type	Both radiators and underfloor
Flow temperature	45°C
System type	Heat Pump
Manufacturer	Mitsubishi Electric Europe B.V.
Model	Ecodan 8.5 kW
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	300 litres
Declared heat loss	1.8 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A

Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

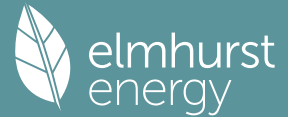
Manufacturer	
Model	

7 Lighting

Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	1.02 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	93%	OK
Manufacturer/Model	ComfoAir 200	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	2 kWp	
Orientation	East	
Pitch	Horizontal	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

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Property Reference	46 Priory Road				Issued on Date	16/05/2024
Assessment Reference	Be Green	Prop Type Ref		Dwelling		
Property	46, Priory Road, Hornsey, London, N8 7EX					
SAP Rating	84 B	DER	4.09	TER	18.38	
Environmental	97 A	% DER < TER				77.75
CO ₂ Emissions (t/year)	0.24	DFEE	57.91	TFEE	73.06	
Compliance Check	See BREL	% DFEE < TFEE				20.74
% DPER < TPER	55.31	DPER	43.55	TPER	97.45	
Assessor Details	Mr. Darren Coham				Assessor ID	R789-0001
Client	District Architetcs, District					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (5)

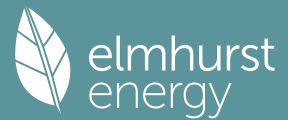
2. Ventilation rate

	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	5.0000 (17)											
Infiltration rate	0.2500 (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) = 0.2125 (21)											
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.3524	0.3471	0.3418	0.3152	0.3099	0.2834	0.2834	0.2781	0.2940	0.3099	0.3206	0.3312 (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
Windows (Uw = 1.20)			21.3500	1.1450	24.4466		(27)
RL1			2.0900	1.1450	2.3931		(27a)
RL2			1.0300	1.1450	1.1794		(27a)
RL3			7.1100	1.1450	8.1412		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000 (28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680 (29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800 (30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200 (30)
Total net area of external elements Aum(A, m ²)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.7871		(33)
Internal Wall 1			90.0000			9.0000	810.0000 (32c)
Internal Floor 1			17.1000			18.0000	307.8000 (32d)
Internal Ceiling 1			17.1000			9.0000	153.9000 (32e)

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Heat capacity $C_m = \text{Sum}(A \times k)$
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.5400	0.0638	0.7363
E3 Sill	10.6400	0.0200	0.2128
E4 Jamb	22.0500	0.0150	0.3307
E5 Ground floor (normal)	37.7800	0.0510	1.9268
E6 Intermediate floor within a dwelling	17.9800	0.0010	0.0180
E16 Corner (normal)	32.9200	0.0380	1.2510
R11 Upstands or kerbs of rooflights	24.8100	0.2400	5.9544
E17 Corner (inverted - internal area greater than external area)	11.0800	-0.0740	-0.8199
E15 Flat roof with parapet	37.7800	0.0840	3.1735
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			12.7835 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss			(33) + (36) + (36a) = 85.5706 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.6700	22.3283	21.9865	20.2780	19.9362	18.2276	18.2276	17.8859	18.9111	19.9362	20.6197	21.3031	(38)
Heat transfer coeff	108.2406	107.8989	107.5572	105.8486	105.5068	103.7983	103.7983	103.4565	104.4817	105.5068	106.1903	106.8737	(39)
Average = Sum(39)m / 12 =												105.7631	
HLP	1.5388	1.5340	1.5291	1.5048	1.5000	1.4757	1.4757	1.4708	1.4854	1.5000	1.5097	1.5194	(40)
HLP (average)												1.5036	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2544 (42)
Hot water usage for mixer showers	85.2743	83.9928	82.1254	78.5525	75.9157	72.9753	71.3039	73.1572	75.1887	78.3459	81.9956	84.9476	(42a)
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023	(42b)
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168	(42c)
Average daily hot water use (litres/day)												137.7493	(43)
Daily hot water use	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667	(44)
Energy conte	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722	(45)
Energy content (annual)										Total = Sum(45)m =		2288.0299	
Distribution loss (46)m = $0.15 \times (45)\text{m}$	35.5832	31.3419	32.9526	28.1229	26.6898	23.4250	22.6529	23.8945	24.5374	28.1114	30.8121	35.0808	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9720	(55)
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	290.6157	257.1731	273.0783	239.1581	231.3264	207.8388	204.4135	212.6911	215.2549	240.8035	257.0858	287.2666	(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	-5.1355	-13.2717	-33.4546	-61.4121	-90.6200	-94.7342	-92.1328	-71.6163	-44.8008	-20.8755	-7.2951	-3.8105	(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	285.4801	243.9015	239.6238	177.7461	140.7064	113.1046	112.2807	141.0748	170.4541	219.9280	249.7908	283.4561	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				2377.5469	(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	121.5916	108.0563	115.7604	103.6767	101.8779	93.2631	92.9294	95.6817	95.7289	105.0291	109.6377	120.4780	(65)

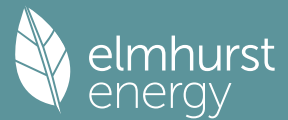
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.9133	110.6183	99.9133	103.2437	99.9133	103.2437	99.9133	99.9133	103.2437	99.9133	103.2437	99.9133	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	163.4296	160.7980	155.5920	143.9955	136.9327	129.5320	124.9051	128.6044	132.9568	141.1681	152.2746	161.9328	(72)
Total internal gains	518.2474	528.3765	507.2855	487.9920	463.6786	446.5254	429.8278	431.4716	444.3344	460.2426	488.5997	508.0105	(73)

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
East	7.5100	19.6403	0.6300	0.7000	0.7700	45.0774 (76)
South	1.8900	46.7521	0.6300	0.7000	0.7700	27.0044 (78)

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West	11.9500	19.6403	0.6300	0.7000	0.7700	71.7277 (80)
East	3.1200	26.0000	0.6300	0.7000	1.0000	32.1965 (82)
West	7.1100	26.0000	0.6300	0.7000	1.0000	73.3709 (82)

Solar gains	249.3770	491.9774	822.4237	1221.5262	1518.5139	1564.4245	1485.2760	1261.1120	963.4352	586.8104	311.6412	204.6552 (83)
Total gains	767.6244	1020.3538	1329.7092	1709.5182	1982.1925	2010.9499	1915.1038	1692.5836	1407.7696	1047.0531	800.2409	712.6656 (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	56.9161	57.0963	57.2777	58.2023	58.3908	59.3520	59.3520	59.5480	58.9637	58.3908	58.0150	57.6440
alpha	4.7944	4.8064	4.8185	4.8802	4.8927	4.9568	4.9568	4.9699	4.9309	4.8927	4.8677	4.8429
util living area	0.9905	0.9665	0.8869	0.6930	0.4869	0.3294	0.2383	0.2808	0.5027	0.8491	0.9761	0.9931 (86)
Living	19.9982	20.2631	20.5950	20.8502	20.9222	20.9359	20.9373	20.9371	20.9253	20.7494	20.3119	19.9600
Non living	18.5364	18.8681	19.2594	19.5353	19.5977	19.6250	19.6256	19.6294	19.6127	19.4565	18.9489	18.4995
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	20.4875	20.2631	20.5950	20.8502	20.9222	20.9359	20.9373	20.9371	20.9253	20.7494	20.3119	20.1055 (87)
Th 2	19.6585	19.6621	19.6657	19.6839	19.6875	19.7058	19.7058	19.7095	19.6985	19.6875	19.6803	19.6730 (88)
util rest of house	0.9866	0.9543	0.8531	0.6336	0.4214	0.2633	0.1683	0.2022	0.4123	0.7918	0.9652	0.9903 (89)
MIT 2	19.2112	18.8681	19.2594	19.5353	19.5977	19.6250	19.6256	19.6294	19.6127	19.4565	18.9489	18.7109 (90)
Living area fraction									fLA = Living area / (4) =			0.3455 (91)
MIT	19.6521	19.3500	19.7208	19.9895	20.0553	20.0779	20.0787	20.0812	20.0661	19.9031	19.4198	19.1927 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6521	19.3500	19.7208	19.9895	20.0553	20.0779	20.0787	20.0812	20.0661	19.9031	19.4198	19.1927 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9866	0.9508	0.8547	0.6480	0.4400	0.2824	0.1885	0.2249	0.4383	0.8024	0.9624	0.9889 (94)
Useful gains	757.3239	970.1237	1136.4844	1107.8505	872.1724	567.8138	361.0096	380.6617	617.0451	840.1582	770.1595	704.7746 (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	1661.7214	1559.1413	1421.9937	1173.8082	881.5407	568.5926	361.0847	380.8398	623.3498	981.5452	1308.2383	1602.3270 (97)
Space heating kWh	672.8718	395.8198	212.4190	47.4895	6.9700	0.0000	0.0000	0.0000	0.0000	105.1919	387.4167	667.7790 (98a)
Space heating requirement - total per year (kWh/year)												2495.9577
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	672.8718	395.8198	212.4190	47.4895	6.9700	0.0000	0.0000	0.0000	0.0000	105.1919	387.4167	667.7790 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2495.9577
Space heating per m2										(98c) / (4) =		35.4842 (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 %)												272.2413 (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	672.8718	395.8198	212.4190	47.4895	6.9700	0.0000	0.0000	0.0000	0.0000	105.1919	387.4167	667.7790 (98)
Space heating efficiency (main heating system 1)	272.2413	272.2413	272.2413	272.2413	272.2413	0.0000	0.0000	0.0000	0.0000	272.2413	272.2413	272.2413 (210)
Space heating fuel (main heating system)	247.1601	145.3930	78.0260	17.4439	2.5602	0.0000	0.0000	0.0000	0.0000	38.6392	142.3064	245.2894 (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	285.4801	243.9015	239.6238	177.7461	140.7064	113.1046	112.2807	141.0748	170.4541	219.9280	249.7908	283.4561 (64)
Efficiency of water heater (217)m	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535 (216)
Fuel for water heating, kWh/month	160.6045	137.2133	134.8068	99.9958	79.1581	63.6300	63.1665	79.3654	95.8935	123.7264	140.5265	159.4658 (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	28.8411	26.0500	28.8411	27.9107	28.8411	27.9107	28.8411	28.8411	27.9107	28.8411	27.9107	28.8411 (231)
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-25.0933	-41.8017	-70.1093	-86.1246	-96.8162	-91.4114	-89.9198	-83.0756	-68.4922	-50.3675	-29.1359	-20.6767 (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	-0.1509	-1.5128	-6.9973	-18.4398	-31.0517	-33.7283	-32.6960	-24.2436	-14.2092	-5.0038	-0.7744	-0.0879 (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												

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Space heating fuel - main system 1	916.8182 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	177.7535
Water heating fuel used	1337.5528 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4280) mechanical ventilation fans (SFP = 1.4280)	339.5808 (230a)
Total electricity for the above, kWh/year	339.5808 (231)
Electricity for lighting (calculated in Appendix L)	155.9017 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-921.9200 (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	1827.9336 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	916.8182	0.1582	145.0458 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1337.5528	0.1441	192.7806 (264)
Space and water heating			337.8264 (265)
Pumps, fans and electric keep-hot	339.5808	0.1387	47.1040 (267)
Energy for lighting	155.9017	0.1443	22.5014 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-753.0241	0.1326	-99.8315
PV Unit electricity exported	-168.8959	0.1161	-19.6081
Total			-119.4397 (269)
Total CO2, kg/year			287.9922 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	916.8182	1.5856	1453.6735 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1337.5528	1.5331	2050.6048 (278)
Space and water heating			3504.2783 (279)
Pumps, fans and electric keep-hot	339.5808	1.5128	513.7178 (281)
Energy for lighting	155.9017	1.5338	239.1273 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-753.0241	1.4899	-1121.9108
PV Unit electricity exported	-168.8959	0.4257	-71.8968
Total			-1193.8077 (283)
Total Primary energy kWh/year			3063.3157 (286)
Dwelling Primary energy Rate (DPER)			43.5500 (287)

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

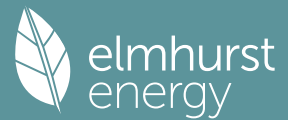
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1539 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)

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Infiltration rate	0.4039 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = $1 - [0.075 \times (19)] = 0.8500$ (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3433 (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 infiltr rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.4377	0.4292	0.4206	0.3777	0.3691	0.3262	0.3262	0.3176	0.3433	0.3691	0.3862	0.4034	(22b)
	0.5958	0.5921	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5814	(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	
TER Opening Type (Uw = 1.20)			11.8900	1.1450	13.6145			(27)
RL1			1.1600	2.0221	2.3456			(27a)
RL2			0.5700	2.0221	1.1526			(27a)
RL3			3.9600	2.0221	8.0074			(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212			(28a)
External Wall 1	153.8088	11.8900	141.9188	0.1800	25.5454			(29a)
Green Roof	53.2400	1.7300	51.5100	0.1100	5.6661			(30)
Flat Roof	10.2900	3.9600	6.3300	0.1100	0.6963			(30)
Total net area of external elements Aum(A, m2)			270.5788					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 63.9490			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 315.3009 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	11.5400	0.0500	0.5770	
E2 Other lintels (including other steel lintels)	10.6400	0.0500	0.5320	
E3 Sill	22.0500	0.0500	1.1025	
E4 Jamb	37.7800	0.1600	6.0448	
E5 Ground floor (normal)	17.9800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	32.9200	0.0900	2.9628	
E16 Corner (normal)	24.8100	0.0800	1.9848	
R11 Upstands or kerbs of rooflights	11.0800	-0.0900	-0.9972	
E17 Corner (inverted - internal area greater than external area)	37.7800	0.5600	21.1568	
E15 Flat roof with parapet				

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.3635 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 97.3125 (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	38.3243	38.0850	37.8505	36.7487	36.5426	35.5830	35.5830	35.4053	35.9526	36.5426	36.9596	37.3956	(38)
Average = Sum(39)m / 12 =	135.6368	135.3975	135.1630	134.0612	133.8551	132.8955	132.8955	132.7178	133.2651	133.8551	134.2721	134.7081	(39)
												134.0602	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.9283	1.9249	1.9216	1.9059	1.9030	1.8893	1.8893	1.8868	1.8946	1.9030	1.9089	1.9151	(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													2.2544 (42)
Hot water usage for mixer showers	62.0177	61.0857	59.7276	57.1291	55.2114	53.0729	51.8574	53.2052	54.6827	56.9788	59.6331	61.7801	(42a)
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023	(42b)
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168	(42c)
Average daily hot water use (litres/day)													116.3075 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	126.5274	123.8259	120.5360	115.5328	111.4700	107.1021	105.4232	108.6990	112.1538	116.7394	121.8197	126.1992	(44)
Energy content (annual)	200.3884	176.3265	185.2593	158.1586	150.0600	131.6945	127.5002	134.5921	138.2969	158.4142	173.5545	197.5974	(45)
Distribution loss (46)m = 0.15 x (45)m													

30.0583 26.4490 27.7889 23.7238 22.5090 19.7542 19.1250 20.1888 20.7445 23.7621 26.0332 29.6396 (46)

Water storage loss:

Store volume 300.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day):

Temperature factor from Table 2b 2.1127 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 1.1409 (55)

35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (56)

If cylinder contains dedicated solar storage 35.3664 31.9439 35.3664 34.2256 35.3664 34.2256 35.3664 35.3664 34.2256 35.3664 34.2256 35.3664 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 259.0173 229.2815 243.8881 214.8961 208.6888 188.4321 186.1290 193.2209 195.0345 217.0431 230.2920 256.2262 (62)

WWHRS -28.3519 -25.0747 -26.2567 -21.7416 -20.2624 -17.3387 -16.2523 -17.2826 -17.9393 -21.1484 -23.9586 -27.8269 (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 230.6653 204.2069 217.6314 193.1545 188.4264 171.0934 169.8768 175.9382 177.0952 195.8946 206.3334 228.3994 (64)

Total per year (kWh/year) = Sum(64)m = 2358.7156 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 113.5322 100.9926 108.5018 97.9778 96.7980 89.1785 89.2969 91.6549 91.3738 99.5758 103.0969 112.6042 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.9133	110.6183	99.9133	103.2437	99.9133	103.2437	99.9133	99.9133	103.2437	99.9133	103.2437	99.9133
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718
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
Losses e.g. evaporation (negative values) (Table 5)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740
Water heating gains (Table 5)	152.5971	150.2866	145.8357	136.0802	130.1048	123.8590	120.0227	123.1921	126.9080	133.8384	143.1902	151.3497
Total internal gains	510.4149	520.8650	500.5292	483.0768	459.8508	440.8524	424.9454	426.0593	438.2856	455.9130	482.5153	500.4274

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
East					4.1800	19.6403		0.6300	0.7000	0.7700		25.0897 (76)
South					1.0500	46.7521		0.6300	0.7000	0.7700		15.0024 (78)
West					6.6600	19.6403		0.6300	0.7000	0.7700		39.9755 (80)
East					1.7300	26.0000		0.6300	0.7000	1.0000		17.8526 (82)
West					3.9600	26.0000		0.6300	0.7000	1.0000		40.8648 (82)
Solar gains	138.7850	273.8029	457.7147	679.8373	845.1253	870.6760	826.6265	701.8691	536.1958	326.5829	173.4375	113.8955 (83)
Total gains	649.1999	794.6679	958.2439	1162.9141	1304.9761	1311.5285	1251.5720	1127.9283	974.4814	782.4959	655.9528	614.3228 (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	45.4200	45.5003	45.5793	45.9539	46.0246	46.3569	46.3569	46.4190	46.2284	46.0246	45.8817	45.7332
alpha	4.0280	4.0334	4.0386	4.0636	4.0683	4.0905	4.0905	4.0946	4.0819	4.0683	4.0588	4.0489
util living area	0.9953	0.9891	0.9708	0.9101	0.7833	0.6049	0.4559	0.5202	0.7792	0.9556	0.9906	0.9963
MIT	19.1700	19.4237	19.8351	20.3608	20.7475	20.9351	20.9839	20.9730	20.8181	20.2692	19.6213	19.1304
Th 2	19.3816	19.3839	19.3861	19.3968	19.3988	19.4081	19.4081	19.4099	19.4045	19.3988	19.3948	19.3905
util rest of house	0.9933	0.9843	0.9576	0.8708	0.6986	0.4737	0.2967	0.3509	0.6586	0.9273	0.9856	0.9946
MIT 2	17.3498	17.6731	18.1898	18.8228	19.2258	19.3822	19.4054	19.4045	19.3097	18.7407	17.9342	17.3051
Living area fraction	17.9786	18.2779	18.7582	19.3542	19.7515	19.9187	19.9507	19.9464	19.8308	19.2687	18.5170	17.9356
MIT	17.9786	18.2779	18.7582	19.3542	19.7515	19.9187	19.9507	19.9464	19.8308	19.2687	18.5170	17.9356
Temperature adjustment												0.0000
adjusted MIT	17.9786	18.2779	18.7582	19.3542	19.7515	19.9187	19.9507	19.9464	19.8308	19.2687	18.5170	17.9356

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9905	0.9794	0.9507	0.8695	0.7195	0.5182	0.3524	0.4104	0.6955	0.9241	0.9815	0.9923
Useful gains	643.0250	778.3335	910.9903	1011.2041	938.9289	679.6639	441.0896	462.9187	677.7050	723.1395	643.8194	609.5800
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
Heat loss rate W	1855.3263	1811.3340	1656.8535	1401.4974	1077.7350	706.8298	445.2980	470.6646	763.7159	1160.3506	1532.9902	1850.3026
Space heating kWh	901.9522	694.1763	554.9222	281.0111	103.2717	0.0000	0.0000	0.0000	0.0000	325.2851	640.2030	923.0976
Space heating requirement - total per year (kWh/year)												4423.9192
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
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	901.9522	694.1763	554.9222	281.0111	103.2717	0.0000	0.0000	0.0000	0.0000	325.2851	640.2030	923.0976
Space heating requirement after solar contribution - total per year (kWh/year)												4423.9192
Space heating per m ²										(98c) / (4) =		62.8934

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	901.9522	694.1763	554.9222	281.0111	103.2717	0.0000	0.0000	0.0000	0.0000	325.2851	640.2030	923.0976
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000
Space heating fuel (main heating system)	977.1963	752.0870	601.2158	304.4541	111.8870	0.0000	0.0000	0.0000	0.0000	352.4215	693.6110	1000.1057
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
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
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
Water heating												

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Water heating requirement	230.6653	204.2069	217.6314	193.1545	188.4264	171.0934	169.8768	175.9382	177.0952	195.8946	206.3334	228.3994 (64)
Efficiency of water heater (217)m	86.8062	86.5804	86.0656	84.8995	82.7700	79.8000	79.8000	79.8000	79.8000	85.1888	86.4243	79.8000 (216)
Fuel for water heating, kWh/month	265.7246	235.8580	252.8668	227.5096	227.6508	214.4028	212.8782	220.4740	221.9238	229.9536	238.7448	86.8570 (217)
Space cooling fuel requirement												262.9603 (219)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	20.7600	16.6545	14.9955	10.9863	8.4862	6.9333	7.7414	10.0625	13.0702	17.1488	19.3696	21.3370 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-44.9959	-61.1292	-84.7351	-91.8027	-96.2092	-88.8601	-87.7638	-84.1761	-77.4796	-68.2248	-48.6428	-39.1793 (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	-32.9579	-68.2996	-133.8892	-198.4634	-259.9315	-260.2523	-257.1722	-218.8543	-161.9186	-96.7488	-43.6944	-26.1398 (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												4792.9786 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.8000
Water heating fuel used												2810.9473 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												167.5452 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-2631.5204 (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												5225.9507 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4792.9786	0.2100	1006.5255 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2810.9473	0.2100	590.2989 (264)
Space and water heating			1596.8244 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	167.5452	0.1443	24.1819 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-873.1984	0.1354	-118.2019
PV Unit electricity exported	-1758.3219	0.1263	-222.0596
Total			-340.2616 (269)
Total CO2, kg/year			1292.6740 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.3800 (273)

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

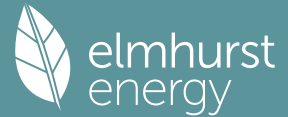
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4792.9786	1.1300	5416.0658 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2810.9473	1.1300	3176.3704 (278)
Space and water heating			8592.4362 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	167.5452	1.5338	256.9864 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-873.1984	1.5003	-1310.0902
PV Unit electricity exported	-1758.3219	0.4636	-815.1434
Total			-2125.2336 (283)
Total Primary energy kWh/year			6854.2899 (286)
Target Primary Energy Rate (TPER)			97.4500 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 194.9194 (5)

2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											3 * 10 =	30.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =										30.0000 / (5) =	0.1539 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											5.0000	(17)
Infiltration rate											0.4039	(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) =	0.3433 (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	0.4377	0.4292	0.4206	0.3777	0.3691	0.3262	0.3262	0.3176	0.3433	0.3691	0.3862	0.4034 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =											0.0000	(23c)
Effective ac	0.5958	0.5921	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5814 (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	
Windows (Uw = 1.20)			21.3500	1.1450	24.4466			(27)
RL1			2.0900	1.1450	2.3931			(27a)
RL2			1.0300	1.1450	1.1794			(27a)
RL3			7.1100	1.1450	8.1412			(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000	(28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680	(29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800	(30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200	(30)
Total net area of external elements Aum(A, m2)			270.5788					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...	(30) + (32) =	72.7871			(33)
Internal Wall 1			90.0000			9.0000	810.0000	(32c)
Internal Floor 1			17.1000			18.0000	307.8000	(32d)
Internal Ceiling 1			17.1000			9.0000	153.9000	(32e)
Heat capacity Cm = Sum(A x k)					(28)...	(30) + (32) + (32a)...	(32e) =	22178.2680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							315.3009	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				11.5400	0.0638	0.7363		
E3 Sill				10.6400	0.0200	0.2128		
E4 Jamb				22.0500	0.0150	0.3307		
E5 Ground floor (normal)				37.7800	0.0510	1.9268		
E6 Intermediate floor within a dwelling				17.9800	0.0010	0.0180		
E16 Corner (normal)				32.9200	0.0380	1.2510		
R11 Upstands or kerbs of rooflights				24.8100	0.2400	5.9544		
E17 Corner (inverted - internal area greater than external area)				11.0800	-0.0740	-0.8199		
E15 Flat roof with parapet				37.7800	0.0840	3.1735		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7835	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	85.5706	(37)

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9914	0.9700	0.9027	0.7322	0.5204	0.3411	0.2278	0.2742	0.5283	0.8714	0.9791	0.9939 (94)
Useful gains	644.4703	877.1716	1098.6344	1175.3150	979.7046	653.7887	415.5045	438.5114	693.0555	823.7257	676.1565	592.5703 (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	1760.7754	1728.3334	1589.1460	1336.2909	1012.0541	657.7503	415.9926	439.6049	717.0688	1106.2550	1455.2994	1753.0367 (97)
Space heating kWh	830.5310	571.9808	364.9407	115.9026	24.0680	0.0000	0.0000	0.0000	0.0000	210.2018	560.9828	863.3870 (98a)
Space heating requirement - total per year (kWh/year)												3541.9946
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	830.5310	571.9808	364.9407	115.9026	24.0680	0.0000	0.0000	0.0000	0.0000	210.2018	560.9828	863.3870 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3541.9946
Space heating per m2										(98c) / (4) =		50.3553 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1138.8441	896.5368	919.4170	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9657	0.9825	0.9698	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1099.8301	880.8109	891.6232	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	2065.4551	1967.0391	1728.0777	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	695.2501	808.1538	622.3222	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	173.8125	202.0384	155.5805	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												531.4315 (107)
Energy for space heating												50.3553 (99)
Energy for space cooling												7.5552 (108)
Total												57.9105 (109)
Fabric Energy Efficiency (DFEE)												57.9 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1539 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4039 (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) = 0.3433 (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	0.4377	0.4292	0.4206	0.3777	0.3691	0.3262	0.3262	0.3176	0.3433	0.3691	0.3862	0.4034 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5958	0.5921	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5814 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			11.8900	1.1450	13.6145		(27)
RL1			1.1600	2.0221	2.3456		(27a)
RL2			0.5700	2.0221	1.1526		(27a)
RL3			3.9600	2.0221	8.0074		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212		(28a)
External Wall 1	153.8088	11.8900	141.9188	0.1800	25.5454		(29a)
Green Roof	53.2400	1.7300	51.5100	0.1100	5.6661		(30)
Flat Roof	10.2900	3.9600	6.3300	0.1100	0.6963		(30)
Total net area of external elements Aum(A, m ²)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.9490		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							315.3009 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	11.5400	0.0500	0.5770
E3 Sill	10.6400	0.0500	0.5320
E4 Jamb	22.0500	0.0500	1.1025
E5 Ground floor (normal)	37.7800	0.1600	6.0448
E6 Intermediate floor within a dwelling	17.9800	0.0000	0.0000
E16 Corner (normal)	32.9200	0.0900	2.9628
R11 Upstands or kerbs of rooflights	24.8100	0.0800	1.9848
E17 Corner (inverted - internal area greater than external area)	11.0800	-0.0900	-0.9972
E15 Flat roof with parapet	37.7800	0.5600	21.1568

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal Bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 97.3125 (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	38.3243	38.0850	37.8505	36.7487	36.5426	35.5830	35.5830	35.4053	35.9526	36.5426	36.9596	37.3956	(38)
Heat transfer coeff	135.6368	135.3975	135.1630	134.0612	133.8551	132.8955	132.8955	132.7178	133.2651	133.8551	134.2721	134.7081	(39)
Average = Sum(39)m / 12 =												134.0602	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.9283	1.9249	1.9216	1.9059	1.9030	1.8893	1.8893	1.8868	1.8946	1.9030	1.9089	1.9151	(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													2.2544 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023	(42b)
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168	(42c)
Average daily hot water use (litres/day)												59.1292	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	64.5097	62.7402	60.8084	58.4037	56.2585	54.0292	53.5658	55.4938	57.4711	59.7606	62.1865	64.4191	(44)
Energy content (annual)	102.1676	89.3413	93.4602	79.9517	75.7348	66.4352	64.7832	68.7129	70.8677	81.0945	88.5961	100.8647	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	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	86.8424	75.9401	79.4412	67.9590	64.3746	56.4699	55.0657	58.4060	60.2375	68.9303	75.3067	85.7350	(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	86.8424	75.9401	79.4412	67.9590	64.3746	56.4699	55.0657	58.4060	60.2375	68.9303	75.3067	85.7350	(64)
12Total per year (kWh/year)												834.7085	(64)
Electric shower(s)	49.6658	44.2527	48.3222	46.1133	46.9786	44.8130	46.3068	46.9786	46.1133	48.3222	47.4136	49.6658	(64a)
Heat gains from water heating, kWh/month	34.1271	30.0482	31.9409	28.5181	27.8383	25.3207	25.3431	26.3461	26.5877	29.3131	30.6801	33.8502	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												564.9461	(64a)

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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.9133	110.6183	99.9133	103.2437	99.9133	103.2437	99.9133	99.9133	103.2437	99.9133	103.2437	99.9133	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	45.8697	44.7146	42.9313	39.6084	37.4171	35.1677	34.0634	35.4115	36.9274	39.3994	42.6112	45.4976	(72)
Total internal gains	400.6876	412.2930	394.6248	383.6050	364.1630	352.1611	338.9861	338.2787	348.3049	358.4739	378.9363	391.5752	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				4.1800	19.6403		0.6300		0.7000		0.7700		25.0897 (76)
South				1.0500	46.7521		0.6300		0.7000		0.7700		15.0024 (78)
West				6.6600	19.6403		0.6300		0.7000		0.7700		39.9755 (80)
East				1.7300	26.0000		0.6300		0.7000		1.0000		17.8526 (82)
West				3.9600	26.0000		0.6300		0.7000		1.0000		40.8648 (82)
Solar gains	138.7850	273.8029	457.7147	679.8373	845.1253	870.6760	826.6265	701.8691	536.1958	326.5829	173.4375	113.8955	(83)
Total gains	539.4726	686.0958	852.3395	1063.4422	1209.2883	1222.8371	1165.6126	1040.1477	884.5007	685.0568	552.3738	505.4707	(84)

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.4200	45.5003	45.5793	45.9539	46.0246	46.3569	46.3569	46.4190	46.2284	46.0246	45.8817	45.7332
alpha	4.0280	4.0334	4.0386	4.0636	4.0683	4.0905	4.0905	4.0946	4.0819	4.0683	4.0588	4.0489
util living area	0.9976	0.9935	0.9801	0.9298	0.8142	0.6386	0.4863	0.5576	0.8185	0.9708	0.9950	0.9982 (86)
MIT	19.0480	19.3057	19.7278	20.2819	20.7048	20.9209	20.9797	20.9654	20.7779	20.1754	19.5077	19.0087 (87)
Th 2	19.3816	19.3839	19.3861	19.3968	19.3988	19.4081	19.4081	19.4099	19.4045	19.3988	19.3948	19.3905 (88)
util rest of house	0.9966	0.9905	0.9707	0.8967	0.7339	0.5043	0.3181	0.3793	0.7047	0.9507	0.9921	0.9974 (89)
MIT 2	17.6770	17.9347	18.3517	18.8825	19.2365	19.3828	19.4054	19.4043	19.3096	18.8016	18.1449	17.6443 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.1506	18.4083	18.8271	19.3660	19.7438	19.9142	19.9493	19.9436	19.8168	19.2762	18.6157	18.1156 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1506	18.4083	18.8271	19.3660	19.7438	19.9142	19.9493	19.9436	19.8168	19.2762	18.6157	18.1156 (93)

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9953	0.9879	0.9663	0.8959	0.7536	0.5500	0.3772	0.4424	0.7392	0.9486	0.9901	0.9964 (94)
Useful gains	536.9427	677.8202	823.5756	952.7781	911.2623	672.5888	439.6989	460.1273	653.8161	649.8178	546.9009	503.6376 (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	1878.6557	1828.9944	1666.1642	1403.0800	1076.6981	706.2306	445.1013	470.2946	761.8554	1161.3574	1546.2385	1874.5485 (97)
Space heating kWh	998.2345	773.5890	626.8859	324.2174	123.0842	0.0000	0.0000	0.0000	0.0000	380.5855	719.5231	1019.9576 (98a)
Space heating requirement - total per year (kWh/year)	4966.0772											
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	998.2345	773.5890	626.8859	324.2174	123.0842	0.0000	0.0000	0.0000	0.0000	380.5855	719.5231	1019.9576 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4966.0772											
Space heating per m2	(98c) / (4) = 70.6010 (99)											

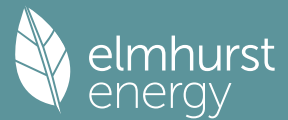
8c. Space cooling requirement												
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1249.2179	983.4268	1008.6554	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8237	0.8877	0.8441	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1029.0219	872.9657	851.3735	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1315.4246	1254.6868	1122.1799	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	206.2099	284.0005	201.4799	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	51.5525	71.0001	50.3700	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	172.9226 (107)											
Energy for space heating	70.6010 (99)											
Energy for space cooling	2.4584 (108)											
Total	73.0594 (109)											
Fabric Energy Efficiency (TFEE)	73.1 (109)											

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

1. Overall dwelling characteristics												
	Area (m2)	Storey height (m)	Volume (m3)									
Ground floor	53.2400 (1b)	x	2.8100 (2b)	=	149.6044 (1b) - (3b)							
First floor	17.1000 (1c)	x	2.6500 (2c)	=	45.3150 (1c) - (3c)							
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400											
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	194.9194 (5)						

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

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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) =											Air changes per hour							
Pressure test											0.0000 / (5) =		0.0000 (8)					
Pressure Test Method											Yes							
Measured/design AP50											Blower Door							
Infiltration rate											5.0000		(17)					
Number of sides sheltered											0.2500		(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) =		0.2125 (21)					

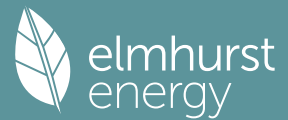
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)						
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)						
Adj infilt rate	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)						
Balanced mechanical ventilation with heat recovery																		
If mechanical ventilation																		
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)																		
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =																		
Effective ac	0.3524	0.3471	0.3418	0.3152	0.3099	0.2834	0.2834	0.2781	0.2940	0.3099	0.3206	0.3312 (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					
Windows (Uw = 1.20)					21.3500		1.1450		24.4466				(27)					
RL1					2.0900		1.1450		2.3931				(27a)					
RL2					1.0300		1.1450		1.1794				(27a)					
RL3					7.1100		1.1450		8.1412				(27a)					
Heatloss Floor 1					53.2400		0.1300		6.9212		110.0000		5856.4000 (28a)					
External Wall 1	153.8088		21.3500		132.4588		0.1800		23.8426		110.0000		14570.4680 (29a)					
Green Roof	53.2400		3.1200		50.1200		0.1100		5.5132		9.0000		451.0800 (30)					
Flat Roof	10.2900		7.1100		3.1800		0.1100		0.3498		9.0000		28.6200 (30)					
Total net area of external elements Aum(A, m2)					270.5788								(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		72.7871						(33)					
Internal Wall 1					90.0000						9.0000		810.0000 (32c)					
Internal Floor 1					17.1000						18.0000		307.8000 (32d)					
Internal Ceiling 1					17.1000						9.0000		153.9000 (32e)					
Heat capacity Cm = Sum(A x k)													(28)...(30) + (32) + (32a)...(32e) =		22178.2680 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K															315.3009 (35)			
List of Thermal Bridges																		
K1 Element													Length		Psi-value		Total	
E2 Other lintels (including other steel lintels)													11.5400		0.0638		0.7363	
E3 Sill													10.6400		0.0200		0.2128	
E4 Jamb													22.0500		0.0150		0.3307	
E5 Ground floor (normal)													37.7800		0.0510		1.9268	
E6 Intermediate floor within a dwelling													17.9800		0.0010		0.0180	
E16 Corner (normal)													32.9200		0.0380		1.2510	
R11 Upstands or kerbs of rooflights													24.8100		0.2400		5.9544	
E17 Corner (inverted - internal area greater than external area)													11.0800		-0.0740		-0.8199	
E15 Flat roof with parapet													37.7800		0.0840		3.1735	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)																	12.7835 (36)	
Point Thermal bridges																	(36a) =	
Total fabric heat loss																	(33) + (36) + (36a) =	
																	85.5706 (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	22.6700	22.3283	21.9865	20.2780	19.9362	18.2276	18.2276	17.8859	18.9111	19.9362	20.6197	21.3031 (38)						
Average = Sum(39)m / 12 =	108.2406	107.8989	107.5572	105.8486	105.5068	103.7983	103.7983	103.4565	104.4817	105.5068	106.1903	106.8737 (39)						
	105.7631											105.7631						
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
HLP (average)	1.5388	1.5340	1.5291	1.5048	1.5000	1.4757	1.4757	1.4708	1.4854	1.5000	1.5097	1.5194 (40)						
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31						
												1.5036						
												31						

4. Water heating energy requirements (kWh/year)																		
Assumed occupancy															2.2544 (42)			
Hot water usage for mixer showers																		
	85.2743	83.9928	82.1254	78.5525	75.9157	72.9753	71.3039	73.1572	75.1887	78.3459	81.9956	84.9476 (42a)						
Hot water usage for baths																		
	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023 (42b)						
Hot water usage for other uses																		
	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168 (42c)						
Average daily hot water use (litres/day)															137.7493 (43)			
Daily hot water use																		
	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667 (44)						
Energy conte																		
	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722 (45)						
Energy content (annual)															Total = Sum(45)m =			
Distribution loss (46)m = 0.15 x (45)m															2288.0299			
	35.5832	31.3419	32.9526	28.1229	26.6898	23.4250	22.6529	23.8945	24.5374	28.1114	30.8121	35.0808 (46)						
Water storage loss:																		
Store volume															300.0000 (47)			
a) If manufacturer declared loss factor is known (kWh/day):															1.8000 (48)			
Temperature factor from Table 2b															0.5400 (49)			
Enter (49) or (54) in (55)															0.9720 (55)			
Total storage loss																		
	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (56)						
If cylinder contains dedicated solar storage																		
	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (57)						
Primary loss																		
	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)						
Combi loss																		
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)						
Total heat required for water heating calculated for each month																		
	290.6157	257.1731	273.0783	239.1581	231.3264	207.8388	204.4135	212.6911	215.2549	240.8035	257.0858	287.2666 (62)						

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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	0.0000 (63a)
PV diverter	-5.1355	-13.2717	-33.4546	-61.4121	-90.6200	-94.7342	-92.1328	-71.6163	-44.8008	-20.8755	-7.2951	-3.8105	(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	285.4801	243.9015	239.6238	177.7461	140.7064	113.1046	112.2807	141.0748	170.4541	219.9280	249.7908	283.4561	(64)
Total per year (kWh/year) = Sum(64)m =													2377.5469 (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	121.5916	108.0563	115.7604	103.6767	101.8779	93.2631	92.9294	95.6817	95.7289	105.0291	109.6377	120.4780	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0695	19.6019	15.9414	12.0686	9.0215	7.6163	8.2297	10.6972	14.3578	18.2305	21.2777	22.6829	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	163.4296	160.7980	155.5920	143.9955	136.9327	129.5320	124.9051	128.6044	132.9568	141.1681	152.2746	161.9328	(72)
Total internal gains	577.0222	574.9911	558.3933	526.4652	495.5789	467.2463	450.1876	453.2865	469.0307	497.5735	532.5035	563.0937	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				7.5100	19.6403	0.6300	0.7000		0.7700		45.0774 (76)	
South				1.8900	46.7521	0.6300	0.7000		0.7700		27.0044 (78)	
West				11.9500	19.6403	0.6300	0.7000		0.7700		71.7277 (80)	
East				3.1200	26.0000	0.6300	0.7000		1.0000		32.1965 (82)	
West				7.1100	26.0000	0.6300	0.7000		1.0000		73.3709 (82)	
Solar gains	249.3770	491.9774	822.4237	1221.5262	1518.5139	1564.4245	1485.2760	1261.1120	963.4352	586.8104	311.6412	204.6552 (83)
Total gains	826.3992	1066.9685	1380.8170	1747.9914	2014.0927	2031.6707	1935.4636	1714.3985	1432.4659	1084.3839	844.1447	767.7489 (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	56.9161	57.0963	57.2777	58.2023	58.3908	59.3520	59.3520	59.5480	58.9637	58.3908	58.0150	57.6440		
alpha	4.7944	4.8064	4.8185	4.8802	4.8927	4.9568	4.9568	4.9699	4.9309	4.8927	4.8677	4.8429		
util living area	0.9871	0.9606	0.8744	0.6816	0.4797	0.3261	0.2358	0.2772	0.4947	0.8352	0.9707	0.9906 (86)		
Living	20.0479	20.2978	20.6201	20.8562	20.9231	20.9359	20.9373	20.9371	20.9261	20.7643	20.3463	20.0074		
Non living	18.5987	18.9099	19.2862	19.5403	19.5983	19.6250	19.6256	19.6294	19.6130	19.4702	18.9905	18.5592		
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	20.5129	20.2978	20.6201	20.8562	20.9231	20.9359	20.9373	20.9371	20.9261	20.7643	20.3463	20.1462 (87)		
Th 2	19.6585	19.6621	19.6657	19.6839	19.6875	19.7058	19.7058	19.7095	19.6985	19.6875	19.6803	19.6730 (88)		
util rest of house	0.9821	0.9467	0.8384	0.6222	0.4150	0.2606	0.1665	0.1997	0.4054	0.7755	0.9577	0.9868 (89)		
MIT 2	19.2360	18.9099	19.2862	19.5403	19.5983	19.6250	19.6256	19.6294	19.6130	19.4702	18.9905	18.7599 (90)		
Living area fraction	19.6771	19.3894	19.7470	19.9949	20.0560	20.0779	20.0787	20.0812	fLA = Living area / (4) =					0.3455 (91)
MIT	19.6771	19.3894	19.7470	19.9949	20.0560	20.0779	20.0787	20.0812	20.0666	19.9173	19.4589	19.2388 (92)		
Temperature adjustment												0.0000		
adjusted MIT	19.6771	19.3894	19.7470	19.9949	20.0560	20.0779	20.0787	20.0812	20.0666	19.9173	19.4589	19.2388 (93)		

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9821	0.9432	0.8409	0.6368	0.4334	0.2795	0.1865	0.2220	0.4311	0.7871	0.9550	0.9852	(94)
Ext temp.	811.6455	1006.3644	1161.0706	1113.1445	872.8407	567.8540	361.0139	380.6737	617.5404	853.5723	806.1391	756.3973	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Space heating kWh	1664.4297	1563.3858	1424.8120	1174.3765	881.6120	568.5972	361.0853	380.8414	623.4044	983.0352	1312.3932	1607.2573	(97)
Space heating requirement - total per year (kWh/year)	634.4714	374.3184	196.2236	44.0871	6.5258	0.0000	0.0000	0.0000	0.0000	96.3204	364.5029	633.0398	(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)	634.4714	374.3184	196.2236	44.0871	6.5258	0.0000	0.0000	0.0000	0.0000	96.3204	364.5029	633.0398	(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	(98d)
Space heating per m2	(98c) / (4) =												33.4019 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												272.2413 (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	634.4714	374.3184	196.2236	44.0871	6.5258	0.0000	0.0000	0.0000	0.0000	96.3204	364.5029	633.0398 (98)
Space heating efficiency (main heating system 1)	272.2413	272.2413	272.2413	272.2413	272.2413	0.0000	0.0000	0.0000	0.0000	272.2413	272.2413	272.2413 (210)
Space heating fuel (main heating system)	233.0548	137.4951	72.0771	16.1941	2.3971	0.0000	0.0000	0.0000	0.0000	35.3805	133.8897	232.5290 (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	285.4801	243.9015	239.6238	177.7461	140.7064	113.1046	112.2807	141.0748	170.4541	219.9280	249.7908	283.4561 (64)
Efficiency of water heater	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535 (216)
Fuel for water heating, kWh/month	160.6045	137.2133	134.8068	99.9958	79.1581	63.6300	63.1665	79.3654	95.8935	123.7264	140.5265	159.4658 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	28.8411	26.0500	28.8411	27.9107	28.8411	27.9107	28.8411	28.8411	27.9107	28.8411	27.9107	28.8411 (231)
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.0378	-41.6981	-69.8948	-86.0208	-96.7948	-91.4114	-89.9198	-83.0756	-68.4922	-50.2749	-29.0729	-20.6386 (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)	-0.2065	-1.6164	-7.2118	-18.5436	-31.0731	-33.7283	-32.6960	-24.2436	-14.2092	-5.0965	-0.8375	-0.1260 (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												863.0173 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.7535
Water heating fuel used												1337.5528 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4280)												
mechanical ventilation fans (SFP = 1.4280)												339.5808 (230a)
Total electricity for the above, kWh/year												339.5808 (231)
Electricity for lighting (calculated in Appendix L)												155.9017 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-921.9200 (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												1774.1327 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	863.0173	16.4900	142.3116 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1337.5528	16.4900	220.5625 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	339.5808	16.4900	55.9969 (249)
Energy for lighting	155.9017	16.4900	25.7082 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-752.3315	16.4900	-124.0595
PV Unit electricity exported	-169.5885	5.5900	-9.4800
Total			-133.5395 (252)
Total energy cost			311.0396 (255)

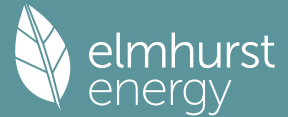
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.9708 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	84.2630
SAP rating (Section 12)		84 (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	863.0173	0.1583	136.5784 (261)
Total CO2 associated with community systems			0.0000 (373)

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Water heating (other fuel)	1337.5528	0.1441	192.7806 (264)
Space and water heating			329.3591 (265)
Pumps, fans and electric keep-hot	339.5808	0.1387	47.1040 (267)
Energy for lighting	155.9017	0.1443	22.5014 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-752.3315	0.1326	-99.7271
PV Unit electricity exported	-169.5885	0.1163	-19.7258
Total			-119.4529 (269)
Total CO ₂ , kg/year			279.5116 (272)
CO ₂ emissions per m ²			3.9700 (273)
EI value			96.7527
EI rating			97 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	194.9194 (5)

2. Ventilation rate

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	5.0000	(17)
Infiltration rate	0.2500	(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) =	0.2125 (21)

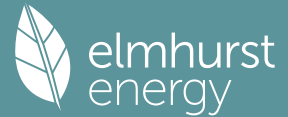
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.3000	4.4000	4.0000	4.0000	3.5000	3.6000	3.8000	3.7000	3.9000	3.9000	4.3000 (22)
Wind factor	1.1500	1.0750	1.1000	1.0000	1.0000	0.8750	0.9000	0.9500	0.9250	0.9750	0.9750	1.0750 (22a)
Adj infilt rate	0.2444	0.2284	0.2338	0.2125	0.2125	0.1859	0.1913	0.2019	0.1966	0.2072	0.2072	0.2284 (22b)
Balanced mechanical ventilation with heat recovery												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)												83.7000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3259	0.3099	0.3152	0.2940	0.2940	0.2674	0.2727	0.2834	0.2781	0.2887	0.2887	0.3099 (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
Windows (U _w = 1.20)			21.3500	1.1450	24.4466		(27)
RL1			2.0900	1.1450	2.3931		(27a)
RL2			1.0300	1.1450	1.1794		(27a)
RL3			7.1100	1.1450	8.1412		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000 (28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680 (29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800 (30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200 (30)
Total net area of external elements A _{um} (A, m ²)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7871		(33)
Internal Wall 1			90.0000			9.0000	810.0000 (32c)
Internal Floor 1			17.1000			18.0000	307.8000 (32d)
Internal Ceiling 1			17.1000			9.0000	153.9000 (32e)
Heat capacity C _m = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 22178.2680 (34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							315.3009 (35)

Element	Length	Psi-value	Total
E1 Element	11.5400	0.0638	0.7363
E2 Other lintels (including other steel lintels)	10.6400	0.0200	0.2128
E3 Sill	22.0500	0.0150	0.3307
E4 Jamb	37.7800	0.0510	1.9268
E5 Ground floor (normal)	17.9800	0.0010	0.0180
E6 Intermediate floor within a dwelling			

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E16 Corner (normal)									32.9200	0.0380	1.2510		
R11 Upstands or kerbs of rooflights									24.8100	0.2400	5.9544		
E17 Corner (inverted - internal area greater than external area)									11.0800	-0.0740	-0.8199		
E15 Flat roof with parapet									37.7800	0.0840	3.1735		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												12.7835 (36)	
Point Thermal bridges										(36a) =		0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		85.5706 (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	
	20.9614	19.9362	20.2780	18.9111	18.9111	17.2025	17.5442	18.2276	17.8859	18.5694	18.5694	19.9362 (38)	
Heat transfer coeff	106.5320	105.5068	105.8486	104.4817	104.4817	102.7731	103.1148	103.7983	103.4565	104.1400	104.1400	105.5068 (39)	
Average = Sum(39)m / 12 =												104.4817	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.5145	1.5000	1.5048	1.4854	1.4854	1.4611	1.4659	1.4757	1.4708	1.4805	1.4805	1.5000 (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													2.2544	(42)
Hot water usage for mixer showers	85.2743	83.9928	82.1254	78.5525	75.9157	72.9753	71.3039	73.1572	75.1887	78.3459	81.9956	84.9476	(42a)	
Hot water usage for baths	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023	(42b)	
Hot water usage for other uses	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168	(42c)	
Average daily hot water use (litres/day)												137.7493	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667	(44)	
Energy content (annual)	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum(45)m =	2288.0299		
Water storage loss:	35.5832	31.3419	32.9526	28.1229	26.6898	23.4250	22.6529	23.8945	24.5374	28.1114	30.8121	35.0808	(46)	
Store volume												300.0000	(47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)	
Temperature factor from Table 2b												0.5400	(49)	
Enter (49) or (54) in (55)												0.9720	(55)	
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)	
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	290.6157	257.1731	273.0783	239.1581	231.3264	207.8388	204.4135	212.6911	215.2549	240.8035	257.0858	287.2666	(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	-6.0144	-13.2736	-33.4591	-64.2111	-90.0014	-102.9722	-100.6210	-80.9241	-51.2955	-23.5834	-8.9313	-4.6257	(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	284.6012	243.8995	239.6192	174.9470	141.3250	104.8666	103.7925	131.7671	163.9594	217.2202	248.1546	282.6409	(64)	
Electric shower(s)										Total per year (kWh/year) =	Sum(64)m =	2336.7932	(64)	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
												0.0000	(64a)	
Heat gains from water heating, kWh/month	121.5916	108.0563	115.7604	103.6767	101.8779	93.2631	92.9294	95.6817	95.7289	105.0291	109.6377	120.4780	(65)	

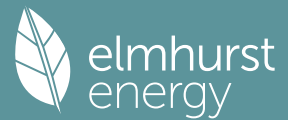
5. Internal gains (see Table 5 and 5a)

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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.0695	19.6019	15.9414	12.0686	9.0215	7.6163	8.2297	10.6972	14.3578	18.2305	21.2777	22.6829	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	(68)	
Pumps, fans	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(69)	
Losses e.g. evaporation (negative values) (Table 5)	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)	
Water heating gains (Table 5)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)	
Total internal gains	163.4296	160.7980	155.5920	143.9955	136.9327	129.5320	124.9051	128.6044	132.9568	141.1681	152.2746	161.9328	(72)	
	577.0222	574.9911	558.3933	526.4652	495.5789	467.2463	450.1876	453.2865	469.0307	497.5735	532.5035	563.0937	(73)	

6. Solar gains

[Jan]													Gains
				Area	Solar flux		g		FF		Access		W
				m2	Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
East				7.5100	21.5869		0.6300		0.7000		0.7700		49.5453 (76)
South				1.8900	49.2853		0.6300		0.7000		0.7700		28.4676 (78)
West				11.9500	21.5869		0.6300		0.7000		0.7700		78.8371 (80)
East				3.1200	29.0000		0.6300		0.7000		1.0000		35.9115 (82)
West				7.1100	29.0000		0.6300		0.7000		1.0000		81.8368 (82)
Solar gains	274.5984	486.3446	814.7920	1253.5793	1502.9199	1658.9484	1580.0687	1373.2057	1055.1380	633.3243	354.4043	230.8264	(83)
Total gains	851.6206	1061.3357	1373.1853	1780.0445	1998.4988	2126.1947	2030.2563	1826.4922	1524.1686	1130.8978	886.9078	793.9201	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.8289	58.3908	58.2023	58.9637	58.9637	59.9440	59.7453	59.3520	59.5480	59.1572	59.1572	58.3908
alpha	4.8553	4.8927	4.8802	4.9309	4.9309	4.9963	4.9830	4.9568	4.9699	4.9438	4.9438	4.8927
util living area	0.9806	0.9508	0.8370	0.6029	0.3948	0.2223	0.1270	0.1534	0.3650	0.7398	0.9496	0.9852 (86)
Living	20.1938	20.4017	20.7137	20.8968	20.9326	20.9378	20.9378	20.9375	20.9355	20.8560	20.5039	20.1595
Non living	18.7969	19.0580	19.4053	19.5899	19.6157	19.6372	19.6334	19.6256	19.6289	19.5682	19.1992	18.7632
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	20.5876	20.4017	20.7137	20.8968	20.9326	20.9378	20.9378	20.9375	20.9355	20.8560	20.5039	20.2771 (87)
Th 2	19.6766	19.6875	19.6839	19.6985	19.6985	19.7168	19.7131	19.7058	19.7095	19.7021	19.7021	19.6875 (88)
util rest of house	0.9727	0.9331	0.7916	0.5381	0.3284	0.1603	0.0616	0.0799	0.2786	0.6591	0.9274	0.9790 (89)
MIT 2	19.3259	19.0580	19.4053	19.5899	19.6157	19.6372	19.6334	19.6256	19.6289	19.5682	19.1992	18.9298 (90)
Living area fraction										FLA = Living area / (4) =		0.3455 (91)
MIT	19.7618	19.5222	19.8573	20.0414	20.0707	20.0865	20.0840	20.0788	20.0803	20.0131	19.6499	19.3952 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7618	19.5222	19.8573	20.0414	20.0707	20.0865	20.0840	20.0788	20.0803	20.0131	19.6499	19.3952 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9734	0.9304	0.7982	0.5556	0.3475	0.1782	0.0805	0.1011	0.3035	0.6799	0.9263	0.9772 (94)
Useful gains	828.9254	987.4756	1096.0660	989.0708	694.4410	378.8199	163.3352	184.6373	462.6421	768.9012	821.5245	775.8240 (95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.5000	18.3000	15.6000	12.1000	8.3000	5.4000 (96)
Heat loss rate W	1529.9873	1447.7838	1276.2513	1017.8000	696.9641	378.8762	163.3357	184.6392	463.5124	824.0656	1181.9832	1476.5895 (97)
Space heating kWh	521.5901	309.3271	134.0579	20.6850	1.8772	0.0000	0.0000	0.0000	0.0000	41.0423	259.5303	521.3695 (98a)
Space heating requirement - total per year (kWh/year)												1809.4793
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	521.5901	309.3271	134.0579	20.6850	1.8772	0.0000	0.0000	0.0000	0.0000	41.0423	259.5303	521.3695 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1809.4793
Space heating per m2										(98c) / (4) =		25.7248 (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 %)												271.9026 (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	521.5901	309.3271	134.0579	20.6850	1.8772	0.0000	0.0000	0.0000	0.0000	41.0423	259.5303	521.3695 (98)
Space heating efficiency (main heating system 1)	271.9026	271.9026	271.9026	271.9026	271.9026	0.0000	0.0000	0.0000	0.0000	271.9026	271.9026	271.9026 (210)
Space heating fuel (main heating system)	191.8297	113.7639	49.3036	7.6075	0.6904	0.0000	0.0000	0.0000	0.0000	15.0945	95.4497	191.7486 (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	284.6012	243.8995	239.6192	174.9470	141.3250	104.8666	103.7925	131.7671	163.9594	217.2202	248.1546	282.6409 (64)
Efficiency of water heater	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283 (216)
Fuel for water heating, kWh/month	159.9527	137.0774	134.6717	98.3244	79.4280	58.9375	58.3339	74.0563	92.1491	122.0829	139.4688	158.8510 (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	28.8411	26.0500	28.8411	27.9107	28.8411	27.9107	28.8411	28.8411	27.9107	28.8411	27.9107	28.8411 (231)
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-27.3853	-41.3721	-69.0367	-86.9459	-96.3237	-93.6838	-92.3213	-86.8716	-72.7769	-53.0174	-32.4309	-23.1118 (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)	-0.4536	-1.9403	-8.0649	-20.2684	-31.0412	-37.2786	-36.3384	-27.9616	-16.5321	-6.4876	-1.4214	-0.3182 (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												665.4880 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.9283
Water heating fuel used												1313.3338 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4280)
mechanical ventilation fans (SFP = 1.4280) 339.5808 (230a)

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Total electricity for the above, kWh/year	339.5808	(231)
Electricity for lighting (calculated in Appendix L)	155.9017	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-963.3837	(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	1510.9206	(238)

10a. Fuel costs - using BEDF prices (542)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	665.4880	25.1600	167.4368 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1313.3338	25.1600	330.4348 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	339.5808	25.1600	85.4385 (249)
Energy for lighting	155.9017	25.1600	39.2249 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-775.2772	25.1600	-195.0598
PV Unit electricity exported	-188.1065	5.8100	-10.9290
Total			-205.9887 (252)
Total energy cost			416.5462 (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	665.4880	0.1592	105.9137 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1313.3338	0.1445	189.7942 (264)
Space and water heating			295.7079 (265)
Pumps, fans and electric keep-hot	339.5808	0.1387	47.1040 (267)
Energy for lighting	155.9017	0.1443	22.5014 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-775.2772	0.1326	-102.7667
PV Unit electricity exported	-188.1065	0.1163	-21.8861
Total			-124.6528 (269)
Total CO2, kg/year			240.6605 (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	665.4880	1.5890	1057.4888 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1313.3338	1.5345	2015.3671 (278)
Space and water heating			3072.8559 (279)
Pumps, fans and electric keep-hot	339.5808	1.5128	513.7178 (281)
Energy for lighting	155.9017	1.5338	239.1273 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-775.2772	1.4898	-1154.9984
PV Unit electricity exported	-188.1065	0.4265	-80.2343
Total			-1235.2327 (283)
Total Primary energy kWh/year			2590.4683 (286)

SAP 10 EPC IMPROVEMENTS

Be Green

Current energy efficiency rating: B 84
Current environmental impact rating: A 97

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.7	-£ 40	-79 kg (32.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£40	1.12 kg/m²	B 86
Total Savings	£40	1.12 kg/m²	A 98
Potential energy efficiency rating:			B 86
Potential environmental impact rating:			A 98

Fuel prices for cost data on this page from database revision number 542 TEST (30 Apr 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):	Current	Potential	Saving
Electricity	£623	£619	£3

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Space heating	£253	£273	-£20
Water heating	£330	£307	£24
Lighting	£39	£39	£0
Generated (PV)	-£206	-£242	£37
Total cost of fuels	£417	£377	£40
Total cost of uses	£416	£377	£41
Delivered energy	21 kWh/m²	12 kWh/m²	9 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.1 tonnes
CO2 emissions per m²	3 kg/m²	2 kg/m²	1 kg/m²
Primary energy	37 kWh/m²	33 kWh/m²	4 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)
Ground floor	53.2400 (1b)	x 2.8100 (2b)	= 149.6044 (1b) - (3b)
First floor	17.1000 (1c)	x 2.6500 (2c)	= 45.3150 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 194.9194 (5)

2. Ventilation rate

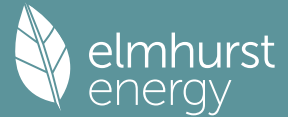
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
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	5.0000 (17)
Infiltration rate	0.2500 (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) = 0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.3524	0.3471	0.3418	0.3152	0.3099	0.2834	0.2834	0.2781	0.2940	0.3099	0.3206	0.3312 (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
Windows (Uw = 1.20)			21.3500	1.1450	24.4466		(27)
RL1			2.0900	1.1450	2.3931		(27a)
RL2			1.0300	1.1450	1.1794		(27a)
RL3			7.1100	1.1450	8.1412		(27a)
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000 (28a)
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680 (29a)
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800 (30)
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200 (30)
Total net area of external elements Aum(A, m2)			270.5788				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.7871		(33)
Internal Wall 1			90.0000			9.0000	810.0000 (32c)
Internal Floor 1			17.1000			18.0000	307.8000 (32d)
Internal Ceiling 1			17.1000			9.0000	153.9000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22178.2680 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							315.3009 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				11.5400	0.0638	0.7363	
E3 Sill				10.6400	0.0200	0.2128	
E4 Jamb				22.0500	0.0150	0.3307	
E5 Ground floor (normal)				37.7800	0.0510	1.9268	
E6 Intermediate floor within a dwelling				17.9800	0.0010	0.0180	
E16 Corner (normal)				32.9200	0.0380	1.2510	

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R11 Upstands or kerbs of rooflights	24.8100	0.2400	5.9544										
E17 Corner (inverted – internal area greater than external area)	11.0800	-0.0740	-0.8199										
E15 Flat roof with parapet	37.7800	0.0840	3.1735										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				12.7835 (36)									
Point Thermal bridges				0.0000 (36a) =									
Total fabric heat loss			(33) + (36) + (36a) =	85.5706 (37)									
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.6700	22.3283	21.9865	20.2780	19.9362	18.2276	18.2276	17.8859	18.9111	19.9362	20.6197	21.3031	(38)
Heat transfer coeff	108.2406	107.8989	107.5572	105.8486	105.5068	103.7983	103.7983	103.4565	104.4817	105.5068	106.1903	106.8737	(39)
Average = Sum(39)m / 12 =												105.7631	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5388	1.5340	1.5291	1.5048	1.5000	1.4757	1.4757	1.4708	1.4854	1.5000	1.5097	1.5194	(40)
HLP (average)												1.5036	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2544 (42)
Hot water usage for mixer showers												84.9476 (42a)
Hot water usage for baths												26.7023 (42b)
Hot water usage for other uses												37.7168 (42c)
Average daily hot water use (litres/day)												137.7493 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667
Energy content (annual)	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722
Distribution loss (46)m = 0.15 x (45)m												2288.0299
Water storage loss:												300.0000 (47)
Store volume												1.8000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.9720 (55)
Enter (49) or (54) in (55)												
Total storage loss												30.1320 (56)
If cylinder contains dedicated solar storage												30.1320 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												287.2666 (62)
WWHRS												0.0000 (63a)
PV diverter												-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												631.6001 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												631.6001
Solar input	-0.0000	-16.1938	-58.8410	-81.2941	-106.7399	-98.4610	-97.7524	-85.1639	-58.4103	-28.7438	-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	290.6157	240.9794	212.8416	151.1105	111.7922	96.7711	93.6342	115.4308	151.4417	210.6640	257.0858	287.2666 (64)
Electric shower(s)												2219.6334 (64)
Heat gains from water heating, kWh/month	121.5916	108.0563	114.6438	98.2739	91.6424	83.1777	82.5078	86.0045	91.4066	103.9125	109.6377	120.4780 (65)

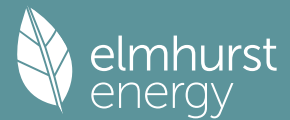
5. Internal gains (see Table 5 and 5a)

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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	22.0695	19.6019	15.9414	12.0686	9.0215	7.6163	8.2297	10.6972	14.3578	18.2305	21.2777	22.6829 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)
Pumps, fans	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Total internal gains	163.4296	160.7980	154.0912	136.4915	123.1753	115.5246	110.8976	115.5975	126.9536	139.6673	152.2746	161.9328 (72)
	577.0222	574.9911	556.8925	518.9612	481.8215	453.2388	436.1801	440.2796	463.0275	496.0727	532.5035	563.0937 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
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	m2		Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W	
East	7.5100		19.6403		0.6300		0.7000		0.7700		45.0774	(76)
South	1.8900		46.7521		0.6300		0.7000		0.7700		27.0044	(78)
West	11.9500		19.6403		0.6300		0.7000		0.7700		71.7277	(80)
East	3.1200		26.0000		0.6300		0.7000		1.0000		32.1965	(82)
West	7.1100		26.0000		0.6300		0.7000		1.0000		73.3709	(82)

Solar gains	249.3770	491.9774	822.4237	1221.5262	1518.5139	1564.4245	1485.2760	1261.1120	963.4352	586.8104	311.6412	204.6552	(83)
Total gains	826.3992	1066.9685	1379.3162	1740.4874	2000.3354	2017.6633	1921.4561	1701.3915	1426.4627	1082.8831	844.1447	767.7489	(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	56.9161	57.0963	57.2777	58.2023	58.3908	59.3520	59.3520	59.5480	58.9637	58.3908	58.0150	57.6440	
alpha	4.7944	4.8064	4.8185	4.8802	4.8927	4.9568	4.9568	4.9699	4.9309	4.8927	4.8677	4.8429	
util living area	0.9871	0.9606	0.8748	0.6838	0.4827	0.3283	0.2375	0.2794	0.4966	0.8357	0.9707	0.9906	(86)
Living	20.0479	20.2978	20.6194	20.8550	20.9227	20.9359	20.9373	20.9371	20.9259	20.7637	20.3463	20.0074	
Non living	18.5987	18.9099	19.2854	19.5393	19.5981	19.6250	19.6256	19.6294	19.6129	19.4697	18.9905	18.5592	
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	20.5129	20.2978	20.6194	20.8550	20.9227	20.9359	20.9373	20.9371	20.9259	20.7637	20.3463	20.1462	(87)
Th 2	19.6585	19.6621	19.6657	19.6839	19.6875	19.7058	19.7058	19.7095	19.6985	19.6875	19.6803	19.6730	(88)
util rest of house	0.9821	0.9467	0.8388	0.6244	0.4177	0.2624	0.1678	0.2012	0.4071	0.7761	0.9577	0.9868	(89)
MIT 2	19.2360	18.9099	19.2854	19.5393	19.5981	19.6250	19.6256	19.6294	19.6129	19.4697	18.9905	18.7599	(90)
Living area fraction	19.6771	19.3894	19.7463	19.9939	20.0557	20.0779	20.0787	20.0812	20.0665	fLA = Living area / (4) =			0.3455 (91)
MIT	19.6771	19.3894	19.7463	19.9939	20.0557	20.0779	20.0787	20.0812	20.0665	19.9167	19.4589	19.2388	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6771	19.3894	19.7463	19.9939	20.0557	20.0779	20.0787	20.0812	20.0665	19.9167	19.4589	19.2388	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9821	0.9432	0.8413	0.6390	0.4362	0.2814	0.1879	0.2237	0.4328	0.7878	0.9550	0.9852	(94)
Useful gains	811.6455	1006.3644	1160.3732	1112.1454	872.5588	567.8271	361.0110	380.6667	617.4238	853.0548	806.1391	756.3973	(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	1664.4297	1563.3858	1424.7322	1174.2694	881.5819	568.5941	361.0848	380.8404	623.3915	982.9778	1312.3932	1607.2573	(97)
Space heating kWh	634.4714	374.3184	196.6831	44.7293	6.7132	0.0000	0.0000	0.0000	0.0000	96.6627	364.5029	633.0398	(98a)
Space heating requirement - total per year (kWh/year)												2351.1208	
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	634.4714	374.3184	196.6831	44.7293	6.7132	0.0000	0.0000	0.0000	0.0000	96.6627	364.5029	633.0398	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2351.1208	
Space heating per m2										(98c) / (4) =		33.4251	(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 %)

272.2413 (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	634.4714	374.3184	196.6831	44.7293	6.7132	0.0000	0.0000	0.0000	0.0000	96.6627	364.5029	633.0398	(98)
Space heating efficiency (main heating system 1)	272.2413	272.2413	272.2413	272.2413	272.2413	0.0000	0.0000	0.0000	0.0000	272.2413	272.2413	272.2413	(210)
Space heating fuel (main heating system)	233.0548	137.4951	72.2459	16.4300	2.4659	0.0000	0.0000	0.0000	0.0000	35.5063	133.8897	232.5290	(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	290.6157	240.9794	212.8416	151.1105	111.7922	96.7711	93.6342	115.4308	151.4417	210.6640	257.0858	287.2666	(64)
Efficiency of water heater	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	177.7535	(216)
Fuel for water heating, kWh/month	163.4936	135.5694	119.7397	85.0113	62.8917	54.4412	52.6764	64.9387	85.1976	118.5147	144.6305	161.6095	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	35.6356	32.1870	35.6356	34.4861	35.6356	34.4861	35.6356	35.6356	34.4861	35.6356	34.4861	35.6356	(231)
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.0761	-41.7573	-69.5972	-85.3319	-95.5426	-91.0109	-89.3614	-82.1782	-68.1879	-50.3236	-29.1526	-20.6654	(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)	-5.8743	-16.3035	-44.6812	-87.4681	-133.0142	-139.3891	-135.6242	-104.7146	-64.2921	-28.2428	-8.8634	-4.3330	(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)

elmhurst
energy

10a. Fuel costs - using Table 12 prices

11a. SAP rating - Individual heating systems

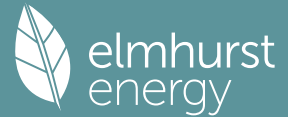
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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

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Full SAP Calculation Printout



2. Ventilation rate

											m3 per hour		
Number of open chimneys											0 * 80 =	0.0000 (6a)	
Number of open flues											0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)	
Number of blocked chimneys											0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											5.0000 (17)		
Infiltration rate											0.2500 (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) =	0.2125 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.6000	4.3000	4.4000	4.0000	4.0000	3.5000	3.6000	3.8000	3.7000	3.9000	3.9000	4.3000 (22)	
Wind factor	1.1500	1.0750	1.1000	1.0000	1.0000	0.8750	0.9000	0.9500	0.9250	0.9750	0.9750	1.0750 (22a)	
Adj infilt rate													
	0.2444	0.2284	0.2338	0.2125	0.2125	0.1859	0.1913	0.2019	0.1966	0.2072	0.2072	0.2284 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													
													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													83.7000 (23c)
Effective ac	0.3259	0.3099	0.3152	0.2940	0.2940	0.2674	0.2727	0.2834	0.2781	0.2887	0.2887	0.3099 (25)	

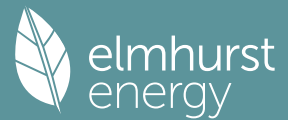
3. Heat losses and heat loss parameter

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						
Windows (Uw = 1.20)			21.3500	1.1450	24.4466			(27)					
RL1			2.0900	1.1450	2.3931			(27a)					
RL2			1.0300	1.1450	1.1794			(27a)					
RL3			7.1100	1.1450	8.1412			(27a)					
Heatloss Floor 1			53.2400	0.1300	6.9212	110.0000	5856.4000	(28a)					
External Wall 1	153.8088	21.3500	132.4588	0.1800	23.8426	110.0000	14570.4680	(29a)					
Green Roof	53.2400	3.1200	50.1200	0.1100	5.5132	9.0000	451.0800	(30)					
Flat Roof	10.2900	7.1100	3.1800	0.1100	0.3498	9.0000	28.6200	(30)					
Total net area of external elements Aum(A, m2)			270.5788					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...	(30) + (32) =	72.7871			(33)					
Internal Wall 1			90.0000			9.0000	810.0000	(32c)					
Internal Floor 1			17.1000			18.0000	307.8000	(32d)					
Internal Ceiling 1			17.1000			9.0000	153.9000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...	(30) + (32) + (32a)...	(32e) =	22178.2680 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								315.3009 (35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				11.5400	0.0638		0.7363						
E3 Sill				10.6400	0.0200		0.2128						
E4 Jamb				22.0500	0.0150		0.3307						
E5 Ground floor (normal)				37.7800	0.0510		1.9268						
E6 Intermediate floor within a dwelling				17.9800	0.0010		0.0180						
E16 Corner (normal)				32.9200	0.0380		1.2510						
R11 Upstands or kerbs of rooflights				24.8100	0.2400		5.9544						
E17 Corner (inverted - internal area greater than external area)				11.0800	-0.0740		-0.8199						
E15 Flat roof with parapet				37.7800	0.0840		3.1735						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								12.7835 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	85.5706 (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	20.9614	19.9362	20.2780	18.9111	18.9111	17.2025	17.5442	18.2276	17.8859	18.5694	18.5694	19.9362	(38)
Average = Sum(39)m / 12 =	106.5320	105.5068	105.8486	104.4817	104.4817	102.7731	103.1148	103.7983	103.4565	104.1400	104.1400	105.5068	(39)
												104.4817	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.5145	1.5000	1.5048	1.4854	1.4854	1.4611	1.4659	1.4757	1.4708	1.4805	1.4805	1.5000	(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												2.2544 (42)
Hot water usage for mixer showers												
Hot water usage for baths	85.2743	83.9928	82.1254	78.5525	75.9157	72.9753	71.3039	73.1572	75.1887	78.3459	81.9956	84.9476
Hot water usage for other uses	26.7929	26.3950	25.8346	24.8014	24.0278	23.1700	22.7066	23.2631	23.8689	24.7868	25.8412	26.7023
Average daily hot water use (litres/day)	37.7168	36.3453	34.9738	33.6022	32.2307	30.8592	30.8592	32.2307	33.6022	34.9738	36.3453	37.7168
												137.7493 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	149.7840	146.7331	142.9338	136.9562	132.1743	127.0044	124.8697	128.6509	132.6598	138.1064	144.1821	149.3667
Energy content (annual)	237.2213	208.9459	219.6839	187.4861	177.9320	156.1668	151.0191	159.2967	163.5829	187.4091	205.4138	233.8722
												Total = Sum(45)m =
												2288.0299

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Distribution loss (46)m = 0.15 x (45)m	35.5832	31.3419	32.9526	28.1229	26.6898	23.4250	22.6529	23.8945	24.5374	28.1114	30.8121	35.0808 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9720 (55)
Total storage loss												
30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)
If cylinder contains dedicated solar storage												
30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(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												
290.6157	257.1731	271.6826	232.4045	218.5321	195.2321	191.3866	200.5947	209.8520	239.4078	257.0858	287.2666	(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												681.4509 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												681.4509
Solar input	-0.0000	-15.8145	-58.4701	-84.8436	-106.7658	-106.7020	-106.4182	-96.0090	-67.7918	-35.3190	-3.3169	-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												
290.6157	241.3586	213.2125	147.5610	111.7662	88.5301	84.9684	104.5857	142.0601	204.0888	253.7690	287.2666	(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												
121.5916	108.0563	114.6438	98.2739	91.6424	83.1777	82.5078	86.0045	91.4066	103.9125	109.6377	120.4780	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
22.0695	19.6019	15.9414	12.0686	9.0215	7.6163	8.2297	10.6972	14.3578	18.2305	21.2777	22.6829	22.6829	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106	282.6106	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	(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)													
-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)													
163.4296	160.7980	154.0912	136.4915	123.1753	115.5246	110.8976	115.5975	126.9536	139.6673	152.2746	161.9328	161.9328	(72)
Total internal gains													
577.0222	574.9911	556.8925	518.9612	481.8215	453.2388	436.1801	440.2796	463.0275	496.0727	532.5035	563.0937	563.0937	(73)

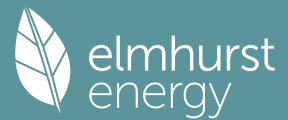
6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d					Gains W
East					7.5100	21.5869	0.6300	0.7000	0.7700					49.5453 (76)
South					1.8900	49.2853	0.6300	0.7000	0.7700					28.4676 (78)
West					11.9500	21.5869	0.6300	0.7000	0.7700					78.8371 (80)
East					3.1200	29.0000	0.6300	0.7000	1.0000					35.9115 (82)
West					7.1100	29.0000	0.6300	0.7000	1.0000					81.8368 (82)
Solar gains	274.5984	486.3446	814.7920	1253.5793	1502.9199	1658.9484	1580.0687	1373.2057	1055.1380	633.3243	354.4043	230.8264 (83)		
Total gains	851.6206	1061.3357	1371.6845	1772.5405	1984.7414	2112.1872	2016.2488	1813.4852	1518.1654	1129.3970	886.9078	793.9201 (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	57.8289	58.3908	58.2023	58.9637	58.9637	59.9440	59.7453	59.3520	59.5480	59.1572	59.1572	58.3908
alpha	4.8553	4.8927	4.8802	4.9309	4.9309	4.9963	4.9830	4.9568	4.9699	4.9438	4.9438	4.8927
util living area												
	0.9806	0.9508	0.8375	0.6050	0.3975	0.2237	0.1279	0.1545	0.3664	0.7405	0.9496	0.9852 (86)
Living	20.1938	20.4017	20.7132	20.8962	20.9325	20.9378	20.9378	20.9375	20.9355	20.8557	20.5039	20.1595
Non living	18.7969	19.0580	19.4047	19.5895	19.6157	19.6372	19.6334	19.6256	19.6289	19.5679	19.1992	18.7632
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	20.5876	20.4017	20.7132	20.8962	20.9325	20.9378	20.9378	20.9375	20.9355	20.8557	20.5039	20.2771 (87)
Th 2	19.6766	19.6875	19.6839	19.6985	19.6985	19.7168	19.7131	19.7058	19.7095	19.7021	19.7021	19.6875 (88)
util rest of house												
	0.9727	0.9331	0.7921	0.5401	0.3306	0.1614	0.0620	0.0805	0.2797	0.6598	0.9274	0.9790 (89)
MIT 2	19.3259	19.0580	19.4047	19.5895	19.6157	19.6372	19.6334	19.6256	19.6289	19.5679	19.1992	18.9298 (90)
Living area fraction												
										fLA = Living area / (4) =		
MIT	19.7618	19.5222	19.8568	20.0409	20.0706	20.0865	20.0840	20.0788	20.0802	20.0128	19.6499	19.3952 (92)
Temperature adjustment												0.0000

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adjusted MIT 19.7618 19.5222 19.8568 20.0409 20.0706 20.0865 20.0840 20.0788 20.0802 20.0128 19.6499 19.3952 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9734	0.9304	0.7987	0.5577	0.3498	0.1793	0.0810	0.1018	0.3047	0.6806	0.9263	0.9772	(94)
Useful gains	828.9254	987.4756	1095.5148	988.5573	694.3537	378.8178	163.3351	184.6372	462.6243	768.6370	821.5245	775.8240	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.5000	18.3000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1529.9873	1447.7838	1276.1899	1017.7458	696.9546	378.8759	163.3357	184.6392	463.5103	824.0371	1181.9832	1476.5895	(97)
Space heating kWh	521.5901	309.3271	134.4223	21.0157	1.9351	0.0000	0.0000	0.0000	0.0000	41.2177	259.5303	521.3695	(98a)
Space heating requirement - total per year (kWh/year)												1810.4078	
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	521.5901	309.3271	134.4223	21.0157	1.9351	0.0000	0.0000	0.0000	0.0000	41.2177	259.5303	521.3695	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1810.4078	
Space heating per m2										(98c) / (4) =		25.7380	(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 %)													271.9026	(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	521.5901	309.3271	134.4223	21.0157	1.9351	0.0000	0.0000	0.0000	0.0000	41.2177	259.5303	521.3695	(98)	
Space heating efficiency (main heating system 1)	271.9026	271.9026	271.9026	271.9026	271.9026	0.0000	0.0000	0.0000	0.0000	271.9026	271.9026	271.9026	(210)	
Space heating fuel (main heating system)	191.8297	113.7639	49.4377	7.7291	0.7117	0.0000	0.0000	0.0000	0.0000	15.1590	95.4497	191.7486	(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	290.6157	241.3586	213.2125	147.5610	111.7662	88.5301	84.9684	104.5857	142.0601	204.0888	253.7690	287.2666	(64)	
Efficiency of water heater	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	177.9283	(216)	
Fuel for water heating, kWh/month	163.3330	135.6493	119.8306	82.9328	62.8153	49.7560	47.7543	58.7797	79.8412	114.7028	142.6243	161.4507	(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	35.6356	32.1870	35.6356	34.4861	35.6356	34.4861	35.6356	35.6356	34.4861	35.6356	34.4861	35.6356	(231)	
Lighting	19.3173	15.4971	13.9534	10.2228	7.8964	6.4514	7.2034	9.3632	12.1619	15.9571	18.0235	19.8542	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-27.4365	-41.4380	-68.7277	-86.1590	-95.0191	-93.2504	-91.6976	-85.7470	-72.2936	-52.9995	-32.5290	-23.1489	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-7.0851	-16.6228	-45.5507	-92.4010	-132.3473	-152.1256	-148.7632	-119.0018	-74.0104	-32.7093	-11.2470	-5.4207	(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													665.8294	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													177.9283	
Water heating fuel used													1219.4699	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4280)														
mechanical ventilation fans (SFP = 1.4280)													339.5808	(230a)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													419.5808	(231)
Electricity for lighting (calculated in Appendix L)													155.9017	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1607.7312	(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													853.0506	(238)

10a. Fuel costs - using BEDF prices (542)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	665.8294	25.1600	167.5227	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1219.4699	25.1600	306.8186	(247)

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Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	339.5808	25.1600	85.4385 (249)
Pump for solar water heating	80.0000	25.1600	20.1280 (249)
Energy for lighting	155.9017	25.1600	39.2249 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-770.4463	25.1600	-193.8443
PV Unit electricity exported	-837.2849	5.8100	-48.6463
Total			-242.4905 (252)
Total energy cost			376.6422 (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	665.8294	0.1591	105.9632 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1219.4699	0.1459	177.8600 (264)
Space and water heating			283.8232 (265)
Pumps, fans and electric keep-hot	419.5808	0.1387	58.2010 (267)
Energy for lighting	155.9017	0.1443	22.5014 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-770.4463	0.1326	-102.1659
PV Unit electricity exported	-837.2849	0.1197	-100.2309
Total			-202.3968 (269)
Total CO2, kg/year			162.1289 (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	665.8294	1.5890	1058.0138 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1219.4699	1.5395	1877.4027 (278)
Space and water heating			2935.4165 (279)
Pumps, fans and electric keep-hot	419.5808	1.5128	634.7418 (281)
Energy for lighting	155.9017	1.5338	239.1273 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-770.4463	1.4900	-1147.9494
PV Unit electricity exported	-837.2849	0.4390	-367.5919
Total			-1515.5412 (283)
Total Primary energy kWh/year			2293.7444 (286)

Predicted Energy Assessment



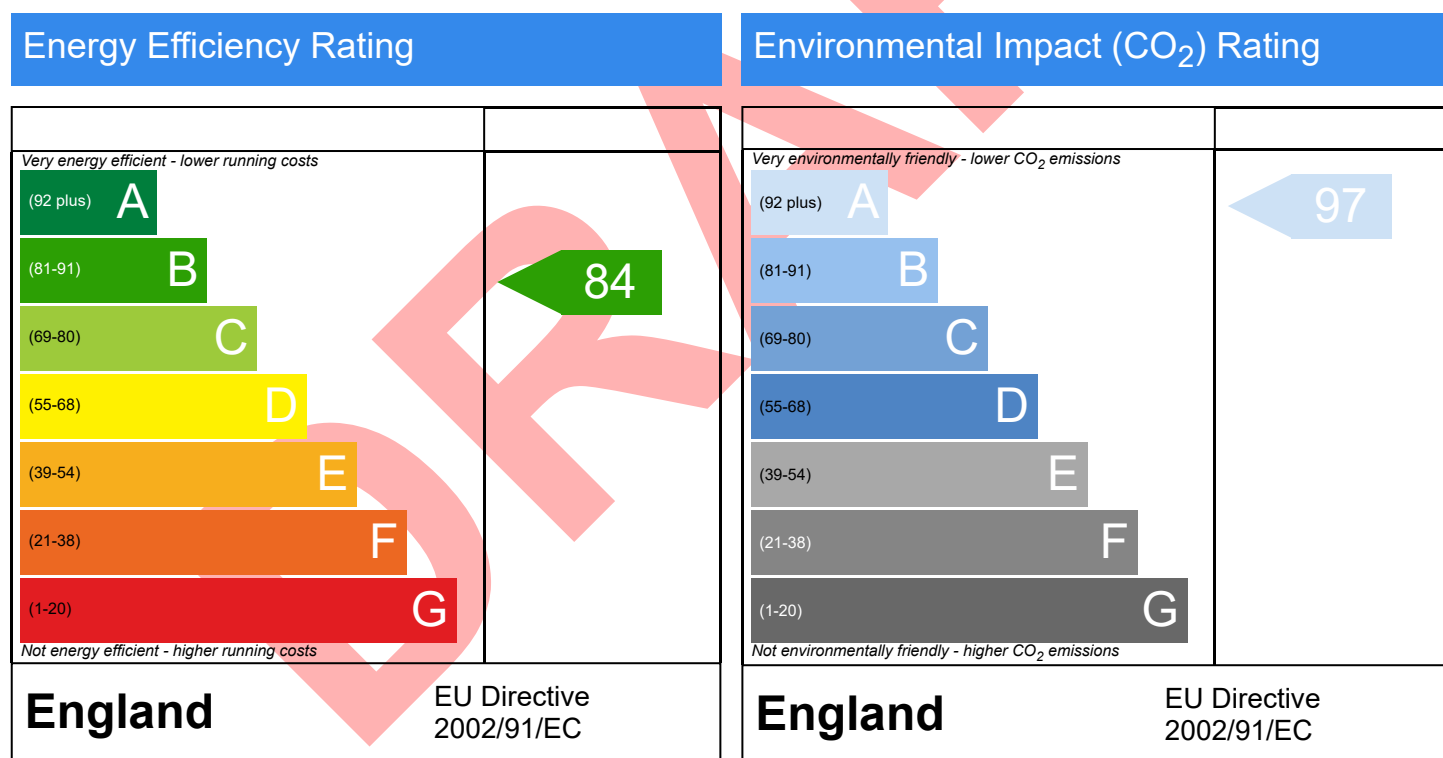
46, Priory Road, Hornsey, London, N8 7EX

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Detached
16/05/2024
Darren Coham
70.34 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.