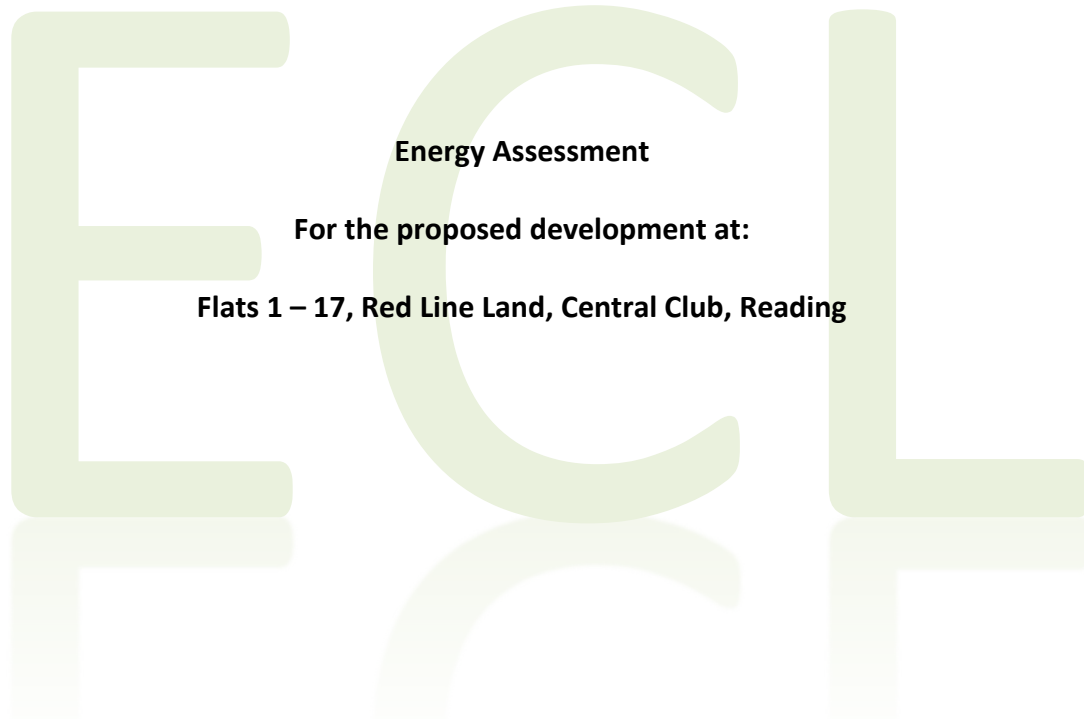




Energy Assessment

For the proposed development at:

Flats 1 – 17, Red Line Land, Central Club, Reading

Energy Calculations Ltd

SAP ◆ CODE ◆ SBEM ◆ DESIGN

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1. Summary.
2. Introduction.
3. Planning requirements.
4. Services and Thermal
5. Results
6. Consideration of Combined Heat and Power and Tri-generation systems & Consideration of Renewable Energy Technologies.

Appendix 1 SAP calculations – Flat 1

1. SUMMARY

The calculations provided, draw upon the detailed SAP 10 assessment. This gives as accurate a guide as possible to the energy usage of the final development in operation.

The Energy Assessment relates to a Planning Application for development of 17 flats at Red Line Land, Central Club Reading

The Energy Assessment sets out to meet the requirements of national and local policies with regard to energy conservation in dwellings, reductions in global climate change gas emissions and the use of renewable technologies to meet energy demand. In particular it meets the requirements of the local planning requirement for a 35% reduction in Co2 over 2021

The assessment of energy demand, the consequent reductions in that demand, and the choice of suitable renewable technologies follow a hierarchical step-wise process:

2. INTRODUCTION

This Energy Assessment relates to a planning application for a new development 17 New Flats at Red Line Lane, Central Club, Reading.

It includes an overview of possible renewable energy technologies and identifies the technology most suitable for this development and reasons why other technologies have been excluded.

Finally, it shows that the selected renewable energy technology will reduce the development's predicted carbon dioxide emissions by **35%** relative to part L 2021 building regulations.

In presenting the information, this Energy Assessment demonstrates that the proposed development will fully satisfy, the current applicable planning policies relating to energy conservation, and renewable energy.

3. PLANNING REQUIREMENTS

3.1 National Policy

3.1.1 KYOTO PROTOCOL

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012. The major distinction between the Protocol and the Convention is that while the Convention encouraged industrialised countries to stabilize GHG emissions, the Protocol commits them to do so.

3.1.2 BUILDING REGULATIONS – PART L 2010

This section of the building regulations deals with the conservation of energy in new domestic and commercial buildings; specifically the energy used for space heating/cooling, water heating, cooking, lighting and appliances. The methodology for the assessment of such has been adopted from the Building Research Establishment's Domestic Energy Model energy assessment method for the domestic portion of the building and Simplified Building Energy Model (SBEM) for the commercial units.

This method requires the calculation of a target emissions rate (TER), which assumes standard or typical building components and the calculation of the buildings actual emissions (DER for SAP). It is a requirement that the building's actual emissions will be lower than the target emission rate.

3.1.3 PLANNING POLICY ASSESSMENT 22: RENEWABLE ENERGY (ODPM, 2004)

Planning Policy Assessment covers the consideration of issues relating to renewable energy technologies and their application to new developments. Technical advice and guidance on the various individual renewable technologies and examples of good practice within development plans and developments are also available. Requirements include:

- a) Renewable energy developments should be capable of being accommodated throughout England in locations where the technology is viable and environmental, economic, and social impacts can be addressed satisfactorily.
- b) The wider environmental and economic benefits of all proposals for renewable energy projects, whatever their scale, are material considerations that should be given significant weight in determining whether proposals should be granted planning permission.
- c) Development proposals should demonstrate any environmental, economic and social benefits as well as how any environmental and social impacts have been minimized through careful consideration of location, scale, design and other measures.
- d)

3.1.4 “ On the 15 June 2022 changes to part L Building regulations came in to force, Part L 2021. Overheating has been removed from SAP and is now an independent regulation part O

4: Services & Thermals

The total CO₂ emissions has been calculated taking full account of energy demands for space heating and hot water, and electricity for pumps, fans, lights.. The baseline was determined by using the typical orientation and the use of building elements (walls, windows etc.) with U-values and other reference values and in most cases consistent with achieving compliance with Approved Document Part LA: 2021. The tabulated calculations results are in appendix 1.

5.1)) SAP Details applied

Applied Details: Domestic

Element	U – Value Element	Element	U – Value Element
Walls	0.18	Floor	0.10
Windows	1.00 (g- value 0.63)	Doors	1.00
Flat roof	0.10	Wall to Lobby	0.15

Services

Accredited construction details applied to table K1 default and LABC

Air pressure test 4.00 or less per unit

100% Low energy lighting

Intermittent extract fans

Air to water heat pump minimum COP winter and summer 170

Under floor heating with time and temperature zone controls

Water cylinder – Applied 170ltr. heat loss 1.32 per 24hr.

Ventilation – Intermittent extract fans

Lighting – Efficacy lm/W

Waste water Heat recovery System – showers

All the details above are required to be checked for the suitability of the build

5: Results - shows the summary for the calculations

TER = Target Emission Rate kgCO₂/ty/m²
 DER = Dwelling Emission Rate kgCO₂/ty/m²
 TFEE = Target Fabric Energy Efficiency kWh/m²/yr
 DFEE = Dwelling Fabric Energy Efficiency kWh/m²/yr
 TPER = Target Primary Energy Rate kWh/m²/yr
 DPER = Dwelling Primary Energy Rate kWh/m²/yr

Table 1

Flat	TER	DER	% Reduction	TFEE	DFEE	% Reduction	DPER	TPER	% Reduction	SAP Rating
1	10.89	3.69	66.12	30.25	24.17	20.08	39.32	56.98	30.99	85 B
2	16.85	5.51	67.30	37.40	33.89	9.39	58.94	89.91	35.45	83 B
3	8.75	2.98	65.94	23.95	20.85	12.93	31.64	45.50	30.46	88 B
4	15.22	5.19	65.90	28.63	31.44	3.46	55.64	81.16	31.44	84 B
5	10.29	3.85	62.59	19.11	18.58	2.75	41.38	54.05	23.44	86 B
6	8.69	3.37	61.22	20.83	19.40	6.86	36.05	45.18	20.21	86 B
7	13.83	5.33	61.46	30.39	29.69	2.29	56.78	73.16	22.39	82 B
8	11.01	3.96	64.03	23.50	21.67	7.81	42.46	57.79	26.53	85 B
9	11.76	4.27	63.69	26.93	25.58	5.01	45.67	61.82	26.12	84 B
10	12.15	4.23	65.19	20.23	18.24	9.84	45.65	64.28	28.98	86 B
11	10.85	3.91	63.96	23.20	21.57	7.04	42.00	56.94	26.24	85 B
12	15.56	5.25	66.26	30.78	30.44	1.10	56.30	82.72	31.94	84 B
13	13.42	4.81	64.16	34.30	33.84	1.37	51.16	70.73	27.67	82 B
14	12.71	4.51	64.52	31.19	30.33	2.75	48.11	66.91	28.10	83 B
15	14.04	4.82	65.46	28.85	28.13	2.47	51.98	74.44	30.17	84 B
16	12.54	4.43	64.67	30.79	29.85	3.06	47.26	66.03	28.43	83 B
17	17.15	5.77	66.36	38.28	38.25	0.07	61.59	91.27	32.52	83 B

6. CONSIDERATION OF Renewable and low carbon technologies

6.1 OVERVIEW OF RENEWABLE ENERGY

Energy from renewable sources has been defined in Article 2 of EU Directive 2010/13/EU '*on the energy performance of buildings*' and includes wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. For the purposes of this energy Assessment and the use of renewable energy on a domestic scale these can be summarised as follows:

- _ Bio-fuels — combustion of solid or liquid bio-fuels to produce heat or electricity.
- _ Decentralised energy.
- _ Heat pumps — extraction of heat from the earth, atmosphere or water bodies.
- _ Hydroelectricity — use of water cycle driven flows to generate electricity.
- _ Photovoltaic — direct generation of electricity from sunlight.
- _ Solar thermal — direct heating of water for space heating or domestic hot water.
- _ Wind turbines — use of solar driven air movement to generate electricity.

The technologies and their potential application to this site are discussed in more detail in the following sections. However, one further pertinent point must be made. The reason for adopting renewable energy technologies is to reduce greenhouse gas emissions, mainly carbon dioxide, and none of the technologies are wholly “zero carbon”. This is because, when the whole life cycle is taken into account some energy has to be put into every system to manufacture and maintain the equipment (which has a finite life) or to operate the equipment, and generally at present this energy is derived from non-renewable sources. Examples include the energy needed to refine and process the silicon used to manufacture photovoltaic panels, the diesel fuel used to transport wood pellets and to power the wood processing machinery for the production of wood fuel pellets.

Finally, due to the dynamic and innovative nature of the renewable energy technology industry even apparently similar products can differ in vital practical details which means that detailed design of installations must be undertaken by experts, often working closely with the product manufacturers, as virtually no two products are identical or interchangeable.

The following sections contain a summary of each possibly applicable technology, and a comparison of the advantages and disadvantages of technologies relevant to this development.

6.2 DECENTRALISED ENERGY

In addition to addressing the well understood and widely accepted planning policy requirement to install systems that will deliver a proportion of the development's energy needs from renewable sources, a further consideration is the availability of decentralised energy. If it is feasible, new developments should incorporate community energy generating schemes so that future developments can be connected or where there are existing networks, the feasibility of connecting the subject development should be investigated. However in this case the development is too small to feasibly construct a new community heating scheme and at present, there is no such network available locally.

6.3 BIO-FUELS

Key planning and design issues regarding the use of bio-fuels include the building space and organisation to accommodate and operate the plant. The equipment would plant space and access and maintenance. Facilities are required for fuel storage and must be provided along with loading access for the fuel to be safely and efficiently delivered and stored. Finally, systems utilising bio fuels, particularly biomass, are rarely available at the small scale that would be appropriate for use in a building where the heat loads are so low.

For these reasons the use of bio-fuels is not considered suitable for this development.

6.4 HEAT PUMPS

Heat pumps collect low temperature heat from renewable sources and "concentrate" it to a usable temperature. Fossil fuel based (grid) electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy. A typical heat pump can deliver 3 kWh of heat energy for every 1 kWh of input energy i.e. an efficiency of 300%. A heat pump operating in this way would therefore be deemed to have delivered 2 kWh of renewable energy. Air source heat pumps have been chosen for the space and hot water for this development.

7.4.1 Ground source heat pumps

There are two types of ground source heat pump system - a closed loop and open loop system. The first circulates anti-freeze through plastic pipe horizontally or vertically, the second uses ground water. Generally they work best where there is a constant heating or cooling demand or the property is off mains gas. In this case the property has access to mains gas and would not have a constant energy demand. Due to the small scale of the site a vertical closed loop system could be considered. Typically boreholes are around 10-100m deep and it is estimated that 1-2 boreholes might be required.

The viability of a heat pump is dependent on the site ground conditions and geology and this requires a geological desk study and trial boreholes to obtain the necessary information. An environmental impact assessment is generally not required for a closed loop system. There is no visual impact to consider as the system is hidden from view.

Due to the uncertainty regarding ground conditions and the small scale of the development a ground source heat pump system is not considered suitable for this development

6.5 HYDROELECTRICITY

There is no suitable source of water in the locality which could be utilised as an energy source.

6.6 PHOTOVOLTAIC

Photovoltaic (PV) systems use areas of semiconductor material that produce electricity when exposed to light. They are connected to the building electricity supply via an inverter which converts the output to a form which is compatible with the mains electricity voltage and frequency. This also allows excess electricity to be exported at times when the actual demand from the dwellings is less than that being produced by the PV system. This ensures that all the electricity produced is used and achieves a reduction in carbon dioxide emissions. For all purposes relating to planning, the exported electricity is by convention treated as if it were used on site.

The output of photovoltaic systems is generally specified as kW peak, or kWp with each 1kWp of system expected to produce an average 850 kWh of electricity per year, although this may be reduced depending on location, orientation and over shading. The area required to produce an output of 1 kWp varies but for this exercise 6.7m² has been used. (The developer will be required to submit a quotation and technical evaluation to ensure that the calculated quantity of panels will produce the required on site generation per annum)

Because the availability of sunlight, to produce electricity, will generally not align with demand, it is normal for the system to be connected to the electricity grid and excess production exported. The introduction of the feed-in-tariff has improved the economics of solar PV systems.

There are no direct environmental consequences from the installation of PV panels but the installation can have a visual impact that may require consideration.

6.7 SOLAR THERMAL PANELS

Solar thermal panels harness solar energy to heat domestic hot water. They are usually used in conjunction with the main heating system as they can only provide a portion of the demand for hot water, depending on the time of year. Overall, it is estimated that a suitably sized system can provide up to 60% of the annual energy demand for providing hot water. These require the installation of a water cylinder in each dwelling. This is not currently planned for as it is proposed to use a combi boiler due to the small size of the dwellings. It is for this reason that solar thermal is not considered entirely suitable for the development.

6.8 WIND TURBINES

Micro wind turbines produce electricity and can be grid-connected in the same way as photovoltaic panels.

Although wind turbines are one of the most cost effective renewable energy technologies, for smaller turbines the capital cost is relatively high compared to the amount of power generated. Adjacent trees and buildings create turbulence and the location affects wind speed and to be effective an average wind speed of no less than 5m/s is required. From the Energy Saving Trust's wind prediction tool, the predicted average wind speed at the development site is 2.4 m/s, significantly less than 5 m/s. In addition noise and vibration from roof mounted turbines can prove unacceptable and wind turbines are less likely to meet with the approval of local residents and planners.

For these reasons wind turbines are not considered suitable for this development.

6.9 Consideration of Heat and power:

Combined Heat and Power (CHP) and Combined Cooling Heat and Power (CCHP) or Tri-generation Systems are recognised as a very desirable way of reducing energy wastage and resulting carbon dioxide emissions.

While generally operating on fossil fuel, mainly natural gas, their advantage is that the waste heat normally associated with electricity generation is put to good use providing space heating and hot water. This means that the overall fuel efficiency can be increased significantly — typically to above 80% compared to 30-40% for grid electricity. The main effect is to approximately halve the carbon dioxide emissions associated with electricity use on the development for all the electricity produced by the CHP plant. However, space and water heating for the development is provided by mains gas and so a CHP unit would only reduce emissions associated with lighting, fans, pumps and domestic appliances. As such, the reduction in CO₂ would not be that great.

Generally CHP and CCHP are most suited to community heating systems particularly where there is a constant demand for heat throughout the year and therefore they are not considered to be viable on developments of less than approximately 50 units.

However, some systems for individual dwellings have been developed such as the Baxi Ecogen micro CHP. However the technology is new and is still proving its long term reliability.

The installation may be complex and can only be carried out by British Gas & one other supplier and therefore is relatively expensive. For these reasons it is considered that micro CHP installations are not a practical option at the present time for a very small development such as this.

Appendix 1 – SAP Calculations Flat 1

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Elmhurst Sap 10 SAP 10 program, 1.0

Date: Thu 06 Oct 2022 11:34:54

Project Information			
Assessed By	Matthew Carter	Building Type	Flat, Semi-detached
OCDEA Registration	EES/003584	Assessment Date	2022-10-06

Dwelling Details			
Assessment Type	As designed	Total Floor Area	85 m ²
Site Reference	00001	Plot Reference	Flat 1
Address	Red Line Land Plot 1, Reading		

Client Details	
Name	Client
Company	Company
Address	Address, Town, AA11 1AA

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	10.89 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.75 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	56.98 kWh _{PE} /m ²		
Dwelling primary energy	39.46 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	30.2 kWh/m ²		
Dwelling fabric energy efficiency	24.2 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	0.17	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.1	Heatloss Floor 1 (0.1)	OK
Roofs	0.16	N/A	N/A	N/A
Windows, doors, and roof windows	1.6	1	Door to Lobby (1)	OK
Rooflights	2.2	N/A	N/A	N/A

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)	38.39	0.18
Sheltered wall: Walls (2)	10.92	0.15
Party wall: Party Wall (1)	22.92	0 (!)
Ground floor: Heatloss Floor 1, Heatloss Floor 1	84.8	0.1 (!)

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]
Door to Lobby, Door	1.8	North	N/A	1 (!)
South, Windows	4.59	South	0.7	1 (!)
West, Windows	8.74	West	0.7	1 (!)
S East, Windows	2.3	South East	0.7	1 (!)

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)	Calculated by person with suitable expertise	0.05	Hightherm
External wall	E3: Sill	Calculated by person with suitable expertise	0.032 (!)	LABC

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.035 (!)	LABC
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.046	LABC
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.042	LABC
External wall	E17: Corner (inverted - internal area greater than external area)	SAP table default	0 (!)	
External wall	E17: Corner (inverted - internal area greater than external area)	SAP table default	0 (!)	K1
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	SAP table default	0 (!)	

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	4.5 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	219.3%
Emitter type	Radiators
Flow temperature	35°C
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	170 litres
Declared heat loss	1.41 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	1
Ecodesign class	1
Manufacturer	1
Model	1

Water heating - type: Cylinder thermostat and HW separately timed

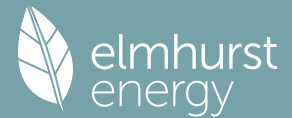
Manufacturer	
Model	

7 Lighting

Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
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: Name:	Assessor ID: Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	00001	Issued on Date	06/10/2022
Assessment Reference	Flat 1	Prop Type Ref	BK001
Property	Plot 1, Red Line Land, Reading		

SAP Rating	85 B	DER	3.75	TER	10.89
Environmental	97 A	% DER<TER	65.56		
CO ₂ Emissions (t/year)	0.28	DFEE	24.18	TFEE	30.25
Compliance Check	See BREL	% DFEE < TFE E	20.07		
% DPER < TPER	30.76	DPER	39.46	TPER	56.98

Assessor Details	Mr. Matthew Carter	Assessor ID	7869-0001
Client	Colony Architects		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenture	ND
Transaction Type	6
Terrain Type	Urban
1.0 Property Type	Flat, Semi-Detached
Position of Flat	Ground-floor flat
Which Floor	0
2.0 Number of Storeys	1
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements	Ground floor:	Heat Loss Perimeter 27.81 m	Internal Floor Area 84.80 m ²	Average Storey Height 2.40 m
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8.0 Living Area	36.14	m ²
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Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
Main	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.18	60.00	54.02	38.39	0.00	None	15.63	Calculate Wall Area
Wall to Lobby	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.15	60.00	12.72	10.92	0.50	Stairwell Access Corridor 1	1.80	Enter Gross Area

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
Party Wall 1	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	22.92		None

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall 1	Plasterboard on timber frame	9.00	121.20

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Ceiling 1	Precast concrete plank floor (screed laid on rubber), carpeted	30.00	84.80

Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.10	None	0.00	75.00	84.80

12.0 Opening Types

Summary for Input Data



Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door Windows	Manufacturer	Door to Corridor Window	Double Low-E Soft 0.05			0.63		0.70	1.00 1.00
13.0 Openings									
Name	Opening Type	Location	Orientation	Area (m²)	Pitch				
Door to Lobby	Door	Wall to Lobby	North	1.80					
South	Windows	Main	South	4.59					
West	Windows	Main	West	8.74					
S East	Windows	Main	South East	2.30					
14.0 Conservatory									
			None						
15.0 Draught Proofing									
			100 %						
16.0 Draught Lobby									
			Yes						
17.0 Thermal Bridging									
			Calculate Bridges						
17.1 List of Bridges									
Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported				
E2 Other lintels (including other steel lintels)	Independently assessed	8.79	0.05	0.05 Hightherm	No				
E3 Sill	Independently assessed	8.79	0.03	0.03 LABC	No				
E4 Jamb	Independently assessed	21.20	0.04	0.04 LABC	No				
E5 Ground floor (normal)	Independently assessed	27.81	0.05	0.05 LABC	No				
E16 Corner (normal)	Independently assessed	9.60	0.04	0.04 LABC	No				
E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	4.80	0.00	0.00	No				
E17 Corner (inverted – internal area greater than external area)	Table K1 - Default	2.40	0.00	0.00 K1	No				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	9.31	0.00	0.00	No				
Y-value	0.02			W/m²K					
18.0 Pressure Testing									
			Yes						
Designed AP ₅₀	4.50			m³/(h.m²) @ 50 Pa					
Test Method	Blower Door								
19.0 Mechanical Ventilation									
Mechanical Ventilation									
Mechanical Ventilation System Present	No								
20.0 Fans, Open Fireplaces, Flues									
21.0 Fixed Cooling System									
			No						
22.0 Lighting									
No Fixed Lighting	No								
	Name	Efficacy	Power	Capacity	Count				
	Lighting 1	90.00	6	540	6				
24.0 Main Heating 1									
			SAP table						
Percentage of Heat	100.00			%					
Fuel Type	Electricity								
SAP Code	224								
In Winter	170.00								
In Summer	170.00								
Controls SAP Code	2207								
PCDF Controls	0								
Is MHS Pumped	Pump in heated space								
Heating Pump Age	2013 or later								
Heat Emitter	Radiators								
Flow Temperature	Enter value								
Flow Temperature Value	35.00								
Heating control function	1								
Heating control ecodesign class	1								
Heating control manufacturer	1								

Summary for Input Data



Heating control model	1
25.0 Main Heating 2	None
26.0 Heat Networks	None

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1									
Heat source 2									
Heat source 3									
Heat source 4									
Heat source 5									

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	0
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Hot Water Cylinder	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Insulation Type	Measured Loss
Cylinder Volume	170.00 L
Loss	1.41 kWh/day
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

None

34.0 Small-scale Hydro

None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement	
		SAP rating	Environmental Impact
		0	0
		0	0
		0	0

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Property Reference	00001	Issued on Date	06/10/2022
Assessment Reference	Flat 1	Prop Type Ref	BK001
Property	Plot 1, Red Line Land, Reading		
SAP Rating	85 B	DER	3.75
Environmental	97 A	% DER<TER	65.56
CO ₂ Emissions (t/year)	0.28	DFEE	24.18
Compliance Check	See BREL	% DFEE < TFE	20.07
% DPER < TPER	30.76	DPER	39.46
Assessor Details	Mr. Matthew Carter	Assessor ID	7869-0001
Client	Colony Architects		

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	84.8000 (1b)	x 2.4000 (2b)	= 203.5200 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 203.5200 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

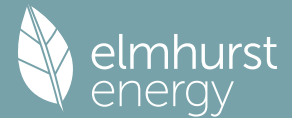
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0983 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.5000 (17)	
Infiltration rate		0.3233 (18)	
Number of sides sheltered		2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2748 (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	0.3503	0.3435	0.3366	0.3023	0.2954	0.2610	0.2610	0.2542	0.2748	0.2954	0.3091	0.3229 (22b)
Effective ac	0.5614	0.5590	0.5567	0.5457	0.5436	0.5341	0.5341	0.5323	0.5378	0.5436	0.5478	0.5521 (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
Door			1.8000	1.0000	1.8000		(26)
Windows (Uw = 1.00)			15.6300	0.9615	15.0288		(27)
Heatloss Floor 1			84.8000	0.1000	8.4800	75.0000	6360.0000 (28a)
Main	54.0240	15.6300	38.3940	0.1800	6.9109	60.0000	2303.6401 (29a)
Wall to Lobby	12.7200	1.8000	10.9200	0.1400	1.5288	60.0000	655.2000 (29a)
Total net area of external elements Aum(A, m ²)			151.5440				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7486		(33)
Party Wall 1			22.9200	0.0000	0.0000	45.0000	1031.4000 (32)

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Party Ceiling 1	84.8000	30.0000	2544.0000 (32b)
Internal Wall 1	121.2000	9.0000	1090.8000 (32c)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 13985.0401 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 164.9179 (35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.7900	0.0500	0.4395
E3 Sill	8.7900	0.0320	0.2813
E4 Jamb	21.2000	0.0350	0.7420
E5 Ground floor (normal)	27.8100	0.0460	1.2793
E16 Corner (normal)	9.6000	0.0420	0.4032
E17 Corner (inverted - internal area greater than external area)	4.8000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.4000	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.3100	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.1452 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	36.8938 (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	37.7025	37.5425	37.3856	36.6487	36.5109	35.8691	35.8691	35.7502	36.1163	36.5109	36.7898	37.0814 (38)
Average = Sum(39)m / 12 =	74.5964	74.4363	74.2794	73.5425	73.4047	72.7629	72.7629	72.6440	73.0101	73.4047	73.6836	73.9752 (39)
	73.5419											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8797	0.8778	0.8759	0.8672	0.8656	0.8581	0.8581	0.8567	0.8610	0.8656	0.8689	0.8723 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

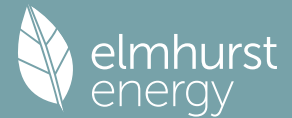
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5477 (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	0.0000 (42a)
Hot water usage for baths	77.1885	76.0421	74.4278	71.4513	69.2225	66.7512	65.4163	67.0193	68.7647	71.4091	74.4469	76.9275	76.9275 (42b)
Hot water usage for other uses	40.7206	39.2398	37.7591	36.2783	34.7976	33.3168	33.3168	34.7976	36.2783	37.7591	39.2398	40.7206	40.7206 (42c)
Average daily hot water use (litres/day)	28.0109	24.6240	25.8641	22.1215	21.0047	18.4568	17.9114	18.9106	19.4293	22.2210	24.2951	27.6313	108.5846 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	117.9090	115.2819	112.1869	107.7296	104.0201	100.0680	98.7331	101.8169	105.0430	109.1682	113.6867	117.6481	117.6481 (44)
Energy content (annual)	186.7391	164.1599	172.4270	147.4765	140.0311	123.0453	119.4091	126.0706	129.5286	148.1402	161.9676	184.2085	184.2085 (45)
Distribution loss (46)m = 0.15 x (45)m	28.0109	24.6240	25.8641	22.1215	21.0047	18.4568	17.9114	18.9106	19.4293	22.2210	24.2951	27.6313	27.6313 (46)
Water storage loss:													
Store volume													170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034 (56)
If cylinder contains dedicated solar storage	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034 (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	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	0.0000 (61)
Total heat required for water heating calculated for each month	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743	231.0743 (62)
WVHRS	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	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 (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	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	0.0000 (63d)
Output from w/h	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743	231.0743 (64)
Total per year (kWh/year)													2355.0105 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	99.5834	88.4475	94.8246	85.3191	84.0530	77.1958	77.1962	79.4111	79.3514	86.7493	90.1374	98.7420	98.7420 (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	117.6320	130.2354	117.6320	121.5531	117.6320	121.5531	117.6320	117.6320	121.5531	117.6320	121.5531	117.6320	117.6320 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.1797	231.5579	225.5650	212.8068	196.7019	181.5655	171.4535	169.0753	175.0682	187.8264	203.9313	219.0677	219.0677 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383 (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	3.0000 (70)

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Losses e.g. evaporation (negative values) (Table 5)	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	(71)
Water heating gains (Table 5)	133.8486	131.6183	127.4525	118.4988	112.9744	107.2163	103.7583	106.7354	110.2103	116.5985	125.1909	132.7177	(72)
Total internal gains	544.8752	557.6265	534.8643	517.0735	491.5232	471.5498	454.0587	454.6575	468.0465	486.2718	514.8902	533.6323	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Southeast				2.3000	36.7938		0.6300	0.7000	0.7700	25.8627 (77)		
South				4.5900	46.7521		0.6300	0.7000	0.7700	65.5821 (78)		
West				8.7400	19.6403		0.6300	0.7000	0.7700	52.4603 (80)		
Solar gains	143.9051	254.0838	366.0995	475.8036	546.8679	547.3510	525.9824	473.4040	404.7492	286.3083	174.1266	121.9429 (83)
Total gains	688.7803	811.7103	900.9638	992.8771	1038.3911	1018.9008	980.0411	928.0615	872.7957	772.5800	689.0167	655.5751 (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		Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	52.0767	52.1887	52.2989	52.8229	52.9221	53.3889	53.3889	53.4763	53.2082	52.9221	52.7218	52.5140
alpha	4.4718	4.4792	4.4866	4.5215	4.5281	4.5593	4.5593	4.5651	4.5472	4.5281	4.5148	4.5009
util living area	0.9671	0.9361	0.8825	0.7714	0.6200	0.4500	0.3253	0.3579	0.5561	0.8142	0.9384	0.9726 (86)
MIT	19.9252	20.1863	20.4766	20.7693	20.9277	20.9865	20.9975	20.9962	20.9658	20.7499	20.2978	19.8757 (87)
Th 2	20.1848	20.1864	20.1880	20.1954	20.1968	20.2033	20.2033	20.2045	20.2008	20.1968	20.1940	20.1911 (88)
util rest of house	0.9610	0.9251	0.8635	0.7393	0.5753	0.3964	0.2670	0.2970	0.4983	0.7794	0.9259	0.9674 (89)
MIT 2	18.9403	19.2652	19.6193	19.9646	20.1339	20.1943	20.2022	20.2027	20.1757	19.9524	19.4141	18.8829 (90)
Living area fraction	19.3600	19.6578	19.9846	20.3075	20.4722	20.5319	20.5411	20.5409	20.5124	fLA = Living area / (4) =		0.4262 (91)
MIT	19.3600	19.6578	19.9846	20.3075	20.4722	20.5319	20.5411	20.5409	20.5124	20.2923	19.7907	19.3060 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3600	19.6578	19.9846	20.3075	20.4722	20.5319	20.5411	20.5409	20.5124	20.2923	19.7907	19.3060 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9534	0.9168	0.8582	0.7440	0.5910	0.4187	0.2918	0.3228	0.5213	0.7838	0.9186	0.9604 (94)
Useful gains	656.6785	744.1962	773.2258	738.6561	613.6619	426.6254	286.0204	299.6192	454.9758	605.5572	632.9331	629.6216 (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												
Space heating kWh	1123.4237	1098.5146	1001.6315	838.9399	643.9219	431.6231	286.7691	300.8086	468.1713	711.4594	935.0946	1117.4687 (97)
Space heating requirement - total per year (kWh/year)	347.2584	238.1020	169.9338	72.2043	22.5134	0.0000	0.0000	0.0000	0.0000	78.7913	217.5563	362.9582 (98a)
Solar heating kWh												1509.3177
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh												0.0000
Space heating requirement after solar contribution - total per year (kWh/year)	347.2584	238.1020	169.9338	72.2043	22.5134	0.0000	0.0000	0.0000	0.0000	78.7913	217.5563	362.9582 (98c)
Space heating per m2												1509.3177
										(98c) / (4) =		17.7986 (99)

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

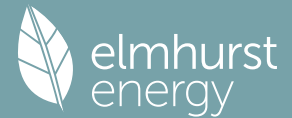
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)	
Fraction of space heat from main system(s)												1.0000 (202)	
Efficiency of main space heating system 1 (in %)												219.3000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (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	347.2584	238.1020	169.9338	72.2043	22.5134	0.0000	0.0000	0.0000	0.0000	78.7913	217.5563	362.9582	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	158.3486	108.5736	77.4892	32.9249	10.2660	0.0000	0.0000	0.0000	0.0000	35.9285	99.2049	165.5076	(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)

elmhurst
energy

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	688.2434	0.1568	107.9458 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1236.8753	0.1409	174.2508 (264)
Space and water heating			282.1966 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	245.6473	0.1443	35.4545 (268)
Total CO ₂ , kg/year			317.6510 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			3.7500 (273)

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	688.2434	1.5806	1087.8479 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1236.8753	1.5209	1881.1900 (278)
Space and water heating			2969.0379 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	245.6473	1.5338	376.7820 (282)
Total Primary energy kWh/year			3345.8199 (286)
Dwelling Primary energy Rate (DPER)			39.4600 (287)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	84.8000 (1b)	x 2.4000 (2b)	= 203.5200 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 203.5200 (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)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1474 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3974 (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) = 0.3378 (21)

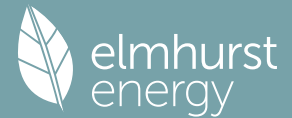
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4307	0.4222	0.4138	0.3716	0.3631	0.3209	0.3209	0.3125	0.3378	0.3631	0.3800	0.3969 (22b)
Effective ac	0.5927	0.5891	0.5856	0.5690	0.5659	0.5515	0.5515	0.5488	0.5571	0.5659	0.5722	0.5788 (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 Opaque door			1.8000	1.0000	1.8000		(26)
TER Opening Type (Uw = 1.20)			15.6300	1.1450	17.8969		(27)
Heatloss Floor 1			84.8000	0.1300	11.0240		(28a)
Main	54.0240	15.6300	38.3940	0.1800	6.9109		(29a)
Wall to Lobby	12.7200	1.8000	10.9200	0.1800	1.9656		(29a)
Total net area of external elements Aum(A, m ²)			151.5440				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.5975		(33)
Party Wall 1			22.9200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.9179 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				8.7900	0.0500	0.4395	
E3 Sill				8.7900	0.0500	0.4395	
E4 Jamb				21.2000	0.0500	1.0600	
E5 Ground floor (normal)				27.8100	0.1600	4.4496	
E16 Corner (normal)				9.6000	0.0900	0.8640	
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0900	-0.4320	
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0900	-0.2160	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				9.3100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6046 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	46.2021 (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	39.8098	39.5679	39.3308	38.2172	38.0089	37.0390	37.0390	36.8593	37.4126	38.0089	38.4304	38.8710 (38)
Average = Sum(39)m / 12 =	86.0119	85.7700	85.5329	84.4193	84.2109	83.2410	83.2410	83.0614	83.6146	84.2109	84.6324	85.0731 (39)
												84.4183
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0143	1.0114	1.0086	0.9955	0.9931	0.9816	0.9816	0.9795	0.9860	0.9931	0.9980	1.0032 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5477 (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	77.1885	76.0421	74.4278	71.4513	69.2225	66.7512	65.4163	67.0193	68.7647	71.4091	74.4469	76.9275 (42b)
Hot water usage for other uses	40.7206	39.2398	37.7591	36.2783	34.7976	33.3168	33.3168	34.7976	36.2783	37.7591	39.2398	40.7206 (42c)
Average daily hot water use (litres/day)												108.5846 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	117.9090	115.2819	112.1869	107.7296	104.0201	100.0680	98.7331	101.8169	105.0430	109.1682	113.6867	117.6481 (44)
Energy content (annual)	186.7391	164.1599	172.4270	147.4765	140.0311	123.0453	119.4091	126.0706	129.5286	148.1402	161.9676	184.2085 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1803.2035
	28.0109	24.6240	25.8641	22.1215	21.0047	18.4568	17.9114	18.9106	19.4293	22.2210	24.2951	27.6313 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5003 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (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	235.1168	207.8559	220.8048	194.2936	188.4088	169.8624	167.7868	174.4483	176.3457	196.5179	208.7847	232.5862 (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	235.1168	207.8559	220.8048	194.2936	188.4088	169.8624	167.7868	174.4483	176.3457	196.5179	208.7847	232.5862 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2372.8119 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	100.7929	89.5400	96.0342	86.4896	85.2625	78.3663	78.4057	80.6206	80.5219	87.9588	91.3079	99.9515 (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	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.6320	130.2354	117.6320	121.5531	117.6320	121.5531	117.6320	117.6320	121.5531	117.6320	121.5531	117.6320 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.1797	231.5579	225.5650	212.8068	196.7019	181.5655	171.4535	169.0753	175.0682	187.8264	203.9313	219.0677 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383 (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)	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063 (71)
Water heating gains (Table 5)	135.4743	133.2440	129.0782	120.1245	114.6001	108.8420	105.3840	108.3611	111.8360	118.2242	126.8166	134.3434 (72)
Total internal gains	546.5009	559.2522	536.4900	518.6992	493.1489	473.1755	455.6844	456.2832	469.6722	487.8975	516.5159	535.2580 (73)

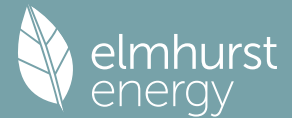
6. Solar gains

[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				
Southeast			2.3000	36.7938	0.6300	0.7000	0.7700	25.8627 (77)				
South			4.5900	46.7521	0.6300	0.7000	0.7700	65.5821 (78)				
West			8.7400	19.6403	0.6300	0.7000	0.7700	52.4603 (80)				
Solar gains	143.9051	254.0838	366.0995	475.8036	546.8679	547.3510	525.9824	473.4040	404.7492	286.3083	174.1266	121.9429 (83)
Total gains	690.4060	813.3360	902.5895	994.5028	1040.0168	1020.5265	981.6668	929.6872	874.4214	774.2057	690.6424	657.2008 (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, n1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.1197	56.2779	56.4339	57.1784	57.3198	57.9877	57.9877	58.1131	57.7286	57.3198	57.0344	56.7389
alpha	4.7413	4.7519	4.7623	4.8119	4.8213	4.8658	4.8658	4.8742	4.8486	4.8213	4.8023	4.7826

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util living area	0.9837	0.9651	0.9286	0.8388	0.6944	0.5112	0.3712	0.4078	0.6270	0.8750	0.9665	0.9867 (86)
MIT	19.8504	20.0948	20.3889	20.7146	20.9070	20.9832	20.9971	20.9955	20.9562	20.6975	20.2247	19.8119 (87)
Th 2	20.0714	20.0738	20.0761	20.0871	20.0891	20.0987	20.0987	20.1005	20.0950	20.0891	20.0850	20.0807 (88)
util rest of house	0.9796	0.9569	0.9124	0.8059	0.6415	0.4435	0.2961	0.3296	0.5561	0.8410	0.9572	0.9834 (89)
MIT 2	18.7464	19.0541	19.4175	19.8074	20.0123	20.0886	20.0976	20.0986	20.0656	19.7996	19.2290	18.7045 (90)
Living area fraction									fLA = Living area / (4) =			0.4262 (91)
MIT	19.2169	19.4976	19.8315	20.1940	20.3936	20.4698	20.4809	20.4808	20.4452	20.1823	19.6533	19.1765 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2169	19.4976	19.8315	20.1940	20.3936	20.4698	20.4809	20.4808	20.4452	20.1823	19.6533	19.1765 (93)

8. Space heating requirement

Utilisation	Jan 0.9748	Feb 0.9508	Mar 0.9075	Apr 0.8100	May 0.6599	Jun 0.4718	Jul 0.3281	Aug 0.3629	Sep 0.5844	Oct 0.8449	Nov 0.9518	Dec 0.9791 (94)
Useful gains	673.0216	773.2950	819.0681	805.5731	686.2731	481.4428	322.0811	337.3802	510.9926	654.1253	657.3577	643.4843 (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	1283.0334	1252.0387	1140.2824	953.4338	732.0986	488.6108	323.0536	338.9598	530.5500	806.9305	1062.4191	1274.0939 (97)
Space heating kwh	453.8487	321.7157	238.9834	106.4597	34.0942	0.0000	0.0000	0.0000	0.0000	113.6871	291.6442	469.1736 (98a)
Space heating requirement - total per year (kWh/year)												2029.6067
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	453.8487	321.7157	238.9834	106.4597	34.0942	0.0000	0.0000	0.0000	0.0000	113.6871	291.6442	469.1736 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2029.6067
Space heating per m2											(98c) / (4) =	23.9340 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan 453.8487	Feb 321.7157	Mar 238.9834	Apr 106.4597	May 34.0942	Jun 0.0000	Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 113.6871	Nov 291.6442	Dec 469.1736 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	491.7104	348.5544	258.9203	115.3410	36.9385	0.0000	0.0000	0.0000	0.0000	123.1713	315.9742	508.3138 (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	235.1168	207.8559	220.8048	194.2936	188.4088	169.8624	167.7868	174.4483	176.3457	196.5179	208.7847	232.5862 (64)
Efficiency of water heater												79.8000 (216)
(217)m	85.5089	85.0357	84.2376	82.7694	81.0589	79.8000	79.8000	79.8000	79.8000	82.8785	84.8094	85.6003 (217)
Fuel for water heating, kWh/month	274.9617	244.4336	262.1215	234.7408	232.4345	212.8602	210.2592	218.6069	220.9846	237.1158	246.1812	271.7119 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	24.4416	19.6080	17.6548	12.9347	9.9911	8.1628	9.1142	11.8470	15.3881	20.1900	22.8046	25.1209 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-28.5659	-41.4235	-61.2216	-70.8345	-78.0949	-73.5006	-72.5843	-67.6723	-59.3011	-48.2454	-31.8062	-24.5632 (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	-12.8220	-27.2940	-54.8524	-83.2762	-110.9905	-111.8533	-110.5522	-93.2154	-67.8023	-39.3438	-17.2182	-10.1166 (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												2198.9238 (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												2866.4117 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	197.2578 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1397.1509 (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	3951.4424 (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	2198.9238	0.2100	461.7740 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2866.4117	0.2100	601.9465 (264)
Space and water heating			1063.7205 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	197.2578	0.1443	28.4704 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-657.8137	0.1340	-88.1477
PV Unit electricity exported	-739.3371	0.1256	-92.8440
Total			-180.9917 (269)
Total CO2, kg/year			923.1284 (272)
Target Carbon Dioxide Emission Rate (TER)			10.8900 (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	2198.9238	1.1300	2484.7839 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2866.4117	1.1300	3239.0452 (278)
Space and water heating			5723.8291 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	197.2578	1.5338	302.5606 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-657.8137	1.4952	-983.5709
PV Unit electricity exported	-739.3371	0.4609	-340.7901
Total			-1324.3610 (283)
Total Primary energy kWh/year			4832.1294 (286)
Target Primary Energy Rate (TPER)			56.9800 (287)

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

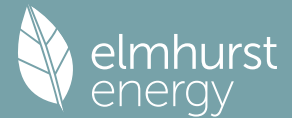
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	84.8000 (1b)	x 2.4000 (2b)	= 203.5200 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 203.5200 (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)

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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 $= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1474$ (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 4.5000 (17)
Infiltration rate 0.3724 (18)
Number of sides sheltered 2 (19)
Shelter factor $(20) = 1 - [0.075 * (19)] = 0.8500$ (20)
Infiltration rate adjusted to include shelter factor $(21) = (18) * (20) = 0.3165$ (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 infiltr rate	0.4036	0.3957	0.3878	0.3482	0.3403	0.3007	0.3007	0.2928	0.3165	0.3403	0.3561	0.3719	(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	0.5814	0.5783	0.5752	0.5606	0.5579	0.5452	0.5452	0.5429	0.5501	0.5579	0.5634	0.5692	(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	
Door			1.8000	1.0000	1.8000			(26)
Windows (Uw = 1.00)			15.6300	0.9615	15.0288			(27)
Heatloss Floor 1			84.8000	0.1000	8.4800	75.0000	6360.0000	(28a)
Main	54.0240	15.6300	38.3940	0.1800	6.9109	60.0000	2303.6401	(29a)
Wall to Lobby	12.7200	1.8000	10.9200	0.1400	1.5288	60.0000	655.2000	(29a)
Total net area of external elements Aum(A, m ²)			151.5440					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 33.7486			(33)
Party Wall 1			22.9200	0.0000	0.0000	45.0000	1031.4000	(32)
Party Ceiling 1			84.8000			70.0000	5936.0000	(32b)
Internal Wall 1			121.2000			9.0000	1090.8000	(32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K $(28)...(30) + (32) + (32a)...(32e) = 17377.0401$ (34)
List of Thermal Bridges 204.9179 (35)

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.7900	0.0500	0.4395	
E3 Sill	8.7900	0.0320	0.2813	
E4 Jamb	21.2000	0.0350	0.7420	
E5 Ground floor (normal)	27.8100	0.0460	1.2793	
E16 Corner (normal)	9.6000	0.0420	0.4032	
E17 Corner (inverted - internal area greater than external area)	4.8000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.4000	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.3100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.1452 (36)
Point Thermal bridges			(36a) = 0.0000	
Total fabric heat loss			(33) + (36) + (36a) = 36.8938	(37)

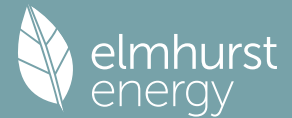
Ventilation heat loss calculated monthly (38)m = $0.33 * (25)m * (5)$
(38)m Jan 39.0507 Feb 38.8383 Mar 38.6301 Apr 37.6522 May 37.4693 Jun 36.6175 Jul 36.6175 Aug 36.4598 Sep 36.9456 Oct 37.4693 Nov 37.8394 Dec 38.2264 (38)
Heat transfer coeff 75.9445 75.7321 75.5239 74.5460 74.3631 73.5114 73.5114 73.3536 73.8394 74.3631 74.7332 75.1202 (39)
Average = Sum(39)m / 12 = 74.5452

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8956	0.8931	0.8906	0.8791	0.8769	0.8669	0.8669	0.8650	0.8707	0.8769	0.8813	0.8859	(40)
HLP (average)												0.8791	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5477	(42)
Hot water usage for mixer showers													0.0000	(42a)
Hot water usage for baths													28.9077	(42b)
Hot water usage for other uses													40.7206	(42c)
Average daily hot water use (litres/day)													63.8207	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	69.6283	67.7182	65.6329	63.0374	60.7220	58.3157	57.8158	59.8968	62.0313	64.5024	67.1208	69.5305	(44)	
Energy content (annual)	110.2742	96.4298	100.8753	86.2951	81.7434	71.7059	69.9231	74.1648	76.4907	87.5291	95.6259	108.8680	(45)	
Distribution loss (46)m = $0.15 * (45)m$													1059.9254	
Water storage loss:													0.0000	(46)
Total storage loss														

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	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	93.7330	81.9653	85.7440	73.3508	69.4819	60.9500	59.4347	63.0401	65.0171	74.3997	81.2820	92.5378 (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	93.7330	81.9653	85.7440	73.3508	69.4819	60.9500	59.4347	63.0401	65.0171	74.3997	81.2820	92.5378 (64)
												Total per year (kWh/year) = Sum(64)m = 900.9366 (64)
12Total per year (kWh/year)												901 (64)
Electric shower(s)	53.6042	47.7618	52.1541	49.7700	50.7039	48.3666	49.9788	50.7039	49.7700	52.1541	51.1734	53.6042 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 609.7451 (64a)
Heat gains from water heating, kWh/month	36.8343	32.4318	34.4745	30.7802	30.0465	27.3292	27.3534	28.4360	28.6968	31.6385	33.1138	36.5355 (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)
(66)m	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.6320	130.2354	117.6320	121.5531	117.6320	121.5531	117.6320	117.6320	121.5531	117.6320	121.5531	117.6320	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.1797	231.5579	225.5650	212.8068	196.7019	181.5655	171.4535	169.0753	175.0682	187.8264	203.9313	219.0677	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	(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)	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	(71)
Water heating gains (Table 5)	49.5085	48.2616	46.3367	42.7503	40.3850	37.9572	36.7653	38.2204	39.8566	42.5248	45.9914	49.1069	(72)
Total internal gains	457.5351	471.2698	450.7486	438.3250	415.9338	402.2906	387.0656	386.1426	397.6928	409.1981	432.6907	447.0214	(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			

Southeast				2.3000	36.7938	0.6300	0.7000	0.7700	25.8627 (77)			
South				4.5900	46.7521	0.6300	0.7000	0.7700	65.5821 (78)			
West				8.7400	19.6403	0.6300	0.7000	0.7700	52.4603 (80)			

Solar gains	143.9051	254.0838	366.0995	475.8036	546.8679	547.3510	525.9824	473.4040	404.7492	286.3083	174.1266	121.9429 (83)
Total gains	601.4402	725.3536	816.8480	914.1286	962.8017	949.6416	913.0481	859.5466	802.4420	695.5064	606.8173	568.9643 (84)

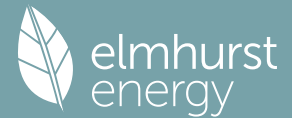
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5590	63.7372	63.9129	64.7513	64.9107	65.6627	65.6627	65.8039	65.3710	64.9107	64.5892	64.2565	
alpha	5.2373	5.2491	5.2609	5.3168	5.3274	5.3775	5.3775	5.3869	5.3581	5.3274	5.3059	5.2838	
util living area	0.9893	0.9724	0.9353	0.8360	0.6787	0.4896	0.3534	0.3910	0.6134	0.8830	0.9752	0.9918	(86)
MIT	19.9507	20.1985	20.4834	20.7845	20.9403	20.9914	20.9988	20.9979	20.9729	20.7508	20.3010	19.9102	(87)
Th 2	20.1713	20.1734	20.1755	20.1853	20.1872	20.1957	20.1957	20.1973	20.1924	20.1872	20.1834	20.1795	(88)
util rest of house	0.9867	0.9660	0.9209	0.8048	0.6299	0.4304	0.2892	0.3236	0.5492	0.8522	0.9682	0.9897	(89)
MIT 2	19.2176	19.4623	19.7377	20.0201	20.1486	20.1917	20.1954	20.1967	20.1781	19.9990	19.5733	19.1842	(90)
Living area fraction									FLA = Living area / (4) =			0.4262	(91)
MIT	19.5300	19.7761	20.0555	20.3459	20.4860	20.5325	20.5378	20.5381	20.5169	20.3194	19.8835	19.4936	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5300	19.7761	20.0555	20.3459	20.4860	20.5325	20.5378	20.5381	20.5169	20.3194	19.8835	19.4936	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9841	0.9623	0.9186	0.8113	0.6484	0.4554	0.3166	0.3523	0.5756	0.8577	0.9652	0.9875	(94)
Ext temp.	591.8804	697.9945	750.3344	741.6439	624.2362	432.4888	289.0593	302.8250	461.8641	596.5230	585.6884	561.8695	(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)

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	1156.6388	1126.5959	1023.7676	853.2438	653.3567	436.1047	289.4700	303.5469	473.8170	722.7642	955.3484	1148.8572 (97)
Space heating kWh	420.1803	288.0201	203.4343	80.3519	21.6656	0.0000	0.0000	0.0000	0.0000	93.9235	266.1552	436.7189 (98a)
Space heating requirement - total per year (kWh/year)												1810.4498
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	420.1803	288.0201	203.4343	80.3519	21.6656	0.0000	0.0000	0.0000	0.0000	93.9235	266.1552	436.7189 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1810.4498
Space heating per m2										(98c) / (4) =		21.3496 (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	691.0067	543.9840	557.4876	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9631	0.9840	0.9771	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	665.4951	535.2733	544.6976	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1062.7904	1022.3587	962.1435	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	286.0527	362.3916	310.5797	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	71.5132	90.5979	77.6449	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												239.7560 (107)
Energy for space heating												21.3496 (99)
Energy for space cooling												2.8273 (108)
Total												24.1770 (109)
Fabric Energy Efficiency (DFEE)												24.2 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	84.8000 (1b)	x 2.4000 (2b)	= 203.5200 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	203.5200 (5)

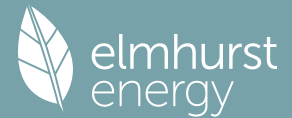
2. Ventilation rate

	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) =	0.1474 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.3974 (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) =		0.3378 (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												

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0.4307 0.4222 0.4138 0.3716 0.3631 0.3209 0.3209 0.3125 0.3378 0.3631 0.3800 0.3969 (22b)
 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) = 0.0000 (23b)
 Effective ac 0.5927 0.5891 0.5856 0.5690 0.5659 0.5515 0.5515 0.5488 0.5571 0.5659 0.5722 0.5788 (23c)
 0.0000 (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 Opaque door			1.8000	1.0000	1.8000			(26)
TER Opening Type (Uw = 1.20)			15.6300	1.1450	17.8969			(27)
Heatloss Floor 1			84.8000	0.1300	11.0240			(28a)
Main	54.0240	15.6300	38.3940	0.1800	6.9109			(29a)
Wall to Lobby	12.7200	1.8000	10.9200	0.1800	1.9656			(29a)
Total net area of external elements Aum(A, m2)			151.5440					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	39.5975		(33)
Party Wall 1			22.9200	0.0000	0.0000			(32)

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

204.9179 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	8.7900	0.0500	0.4395	
E3 Sill	8.7900	0.0500	0.4395	
E4 Jamb	21.2000	0.0500	1.0600	
E5 Ground floor (normal)	27.8100	0.1600	4.4496	
E16 Corner (normal)	9.6000	0.0900	0.8640	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.3100	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.6046 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	46.2021 (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	39.8098	39.5679	39.3308	38.2172	38.0089	37.0390	37.0390	36.8593	37.4126	38.0089	38.4304	38.8710	(38)
Heat transfer coeff	86.0119	85.7700	85.5329	84.4193	84.2109	83.2410	83.2410	83.0614	83.6146	84.2109	84.6324	85.0731	(39)
Average = Sum(39)m / 12 =												84.4183	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0143	1.0114	1.0086	0.9955	0.9931	0.9816	0.9816	0.9795	0.9860	0.9931	0.9980	1.0032	(40)
HLP (average)												0.9955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5477 (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	28.9077	28.4784	27.8738	26.7591	25.9244	24.9989	24.4989	25.0993	25.7529	26.7433	27.8810	28.8100	(42b)
Hot water usage for other uses	40.7206	39.2398	37.7591	36.2783	34.7976	33.3168	33.3168	34.7976	36.2783	37.7591	39.2398	40.7206	(42c)
Average daily hot water use (litres/day)												63.8207	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	69.6283	67.7182	65.6329	63.0374	60.7220	58.3157	57.8158	59.8968	62.0313	64.5024	67.1208	69.5305	(44)
Energy conte	110.2742	96.4298	100.8753	86.2951	81.7434	71.7059	69.9231	74.1648	76.4907	87.5291	95.6259	108.8680	(45)
Energy content (annual)													
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)

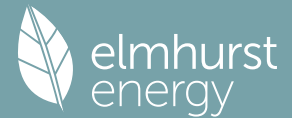
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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													

WWHRS	93.7330	81.9653	85.7440	73.3508	69.4819	60.9500	59.4347	63.0401	65.0171	74.3997	81.2820	92.5378	(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)
	93.7330	81.9653	85.7440	73.3508	69.4819	60.9500	59.4347	63.0401	65.0171	74.3997	81.2820	92.5378	(64)
Total per year (kWh/year) = Sum(64)m =												900.9366	(64)
12Total per year (kWh/year)												901	(64)

Electric shower(s)	53.6042	47.7618	52.1541	49.7700	50.7039	48.3666	49.9788	50.7039	49.7700	52.1541	51.1734	53.6042	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												609.7451	(64a)

Heat gains from water heating, kWh/month	36.8343	32.4318	34.4745	30.7802	30.0465	27.3292	27.3534	28.4360	28.6968	31.6385	33.1138	36.5355	(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	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	127.3829	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.6320	130.2354	117.6320	121.5531	117.6320	121.5531	117.6320	117.6320	121.5531	117.6320	121.5531	117.6320	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.1797	231.5579	225.5650	212.8068	196.7019	181.5655	171.4535	169.0753	175.0682	187.8264	203.9313	219.0677	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	35.7383	(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)	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	(71)
Water heating gains (Table 5)	49.5085	48.2616	46.3367	42.7503	40.3850	37.9572	36.7653	38.2204	39.8566	42.5248	45.9914	49.1069	(72)
Total internal gains	457.5351	471.2698	450.7486	438.3250	415.9338	402.2906	387.0656	386.1426	397.6928	409.1981	432.6907	447.0214	(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			

Southeast				2.3000	36.7938	0.6300	0.7000	0.7700	25.8627 (77)			
South				4.5900	46.7521	0.6300	0.7000	0.7700	65.5821 (78)			
West				8.7400	19.6403	0.6300	0.7000	0.7700	52.4603 (80)			

Solar gains	143.9051	254.0838	366.0995	475.8036	546.8679	547.3510	525.9824	473.4040	404.7492	286.3083	174.1266	121.9429 (83)
Total gains	601.4402	725.3536	816.8480	914.1286	962.8017	949.6416	913.0481	859.5466	802.4420	695.5064	606.8173	568.9643 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, n _{l,m} (see Table 9a)													21.0000	(85)
tau	56.1197	56.2779	56.4339	57.1784	57.3198	57.9877	57.9877	58.1131	57.7286	57.3198	57.0344	56.7389		
alpha	4.7413	4.7519	4.7623	4.8119	4.8213	4.8658	4.8658	4.8742	4.8486	4.8213	4.8023	4.7826		
util living area	0.9906	0.9772	0.9486	0.8705	0.7332	0.5457	0.3983	0.4397	0.6712	0.9083	0.9794	0.9926	(86)	
MIT	19.7239	19.9791	20.2927	20.6559	20.8823	20.9778	20.9960	20.9937	20.9415	20.6277	20.1132	19.6845	(87)	
Th 2	20.0714	20.0738	20.0761	20.0871	20.0891	20.0987	20.0987	20.1005	20.0950	20.0891	20.0850	20.0807	(88)	
util rest of house	0.9881	0.9715	0.9360	0.8411	0.6812	0.4747	0.3181	0.3561	0.5991	0.8803	0.9733	0.9907	(89)	
MIT 2	18.9143	19.1673	19.4733	19.8196	20.0119	20.0881	20.0975	20.0984	20.0636	19.8041	19.3105	18.8825	(90)	
Living area fraction									f _{LA} = Living area / (4) =			0.4262	(91)	
MIT	19.2593	19.5133	19.8225	20.1760	20.3828	20.4673	20.4804	20.4800	20.4378	20.1551	19.6526	19.2243	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.2593	19.5133	19.8225	20.1760	20.3828	20.4673	20.4804	20.4800	20.4378	20.1551	19.6526	19.2243	(93)	

8. Space heating requirement

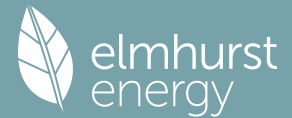
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9853	0.9673	0.9320	0.8443	0.6987	0.5043	0.3523	0.3917	0.6275	0.8826	0.9697	0.9883	(94)
Useful gains	592.6264	701.6125	761.3047	771.7649	672.7368	478.8743	321.6797	336.6813	503.5259	613.8281	588.4300	562.3234	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1286.6809	1253.3792	1139.5155	951.9109	731.1901	488.3987	323.0125	338.8892	529.9294	804.6472	1062.3599	1278.1641	(97)
Space heating kWh	516.3766	370.7872	281.3889	129.7051	43.4893	0.0000	0.0000	0.0000	0.0000	141.9694	341.2295	532.5854	(98a)
Space heating requirement - total per year (kWh/year)												2357.5314	
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	516.3766	370.7872	281.3889	129.7051	43.4893	0.0000	0.0000	0.0000	0.0000	141.9694	341.2295	532.5854	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2357.5314	
Space heating per m ²										(98c) / (4) =		27.8011	(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	782.4656	615.9836	631.2667	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9287	0.9644	0.9519	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	726.6945	594.0521	600.8798	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1062.7904	1022.3587	962.1435	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	241.9890	318.6601	268.7802	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	60.4973	79.6650	67.1950	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												207.3573 (107)
Energy for space heating												27.8011 (99)
Energy for space cooling												2.4453 (108)
Total												30.2463 (109)
Fabric Energy Efficiency (TFEE)												30.2 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	84.8000 (1b)	x 2.4000 (2b)	= 203.5200 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	203.5200 (5)

2. Ventilation rate

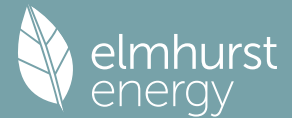
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.0983 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3233 (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) = 0.2748 (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	0.3503	0.3435	0.3366	0.3023	0.2954	0.2610	0.2610	0.2542	0.2748	0.2954	0.3091	0.3229 (22b)
Effective ac	0.5614	0.5590	0.5567	0.5457	0.5436	0.5341	0.5341	0.5323	0.5378	0.5436	0.5478	0.5521 (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
Door			1.8000	1.0000	1.8000		(26)
Windows (Uw = 1.00)			15.6300	0.9615	15.0288		(27)
Heatloss Floor 1			84.8000	0.1000	8.4800	75.0000	6360.0000 (28a)
Main	54.0240	15.6300	38.3940	0.1800	6.9109	60.0000	2303.6491 (29a)
Wall to Lobby	12.7200	1.8000	10.9200	0.1400	1.5288	60.0000	655.2000 (29a)
Total net area of external elements Aum(A, m ²)			151.5440				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.7486		(33)
Party Wall 1			22.9200	0.0000	0.0000	45.0000	1031.4000 (32)
Party Ceiling 1			84.8000			70.0000	5936.0000 (32b)
Internal Wall 1			121.2000			9.0000	1090.8000 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.7900	0.0500	0.4395
E3 Sill	8.7900	0.0320	0.2813
E4 Jamb	21.2000	0.0350	0.7420
E5 Ground floor (normal)	27.8100	0.0460	1.2793
E16 Corner (normal)	9.6000	0.0420	0.4032
E17 Corner (inverted - internal area greater than external area)	4.8000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.4000	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.3100	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.1452 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 36.8938 (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	37.7025	37.5425	37.3856	36.6487	36.5109	35.8691	35.8691	35.7502	36.1163	36.5109	36.7898	37.0814 (38)
Heat transfer coeff	74.5964	74.4363	74.2794	73.5425	73.4047	72.7629	72.7629	72.6440	73.0101	73.4047	73.6836	73.9752 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$												73.5419
HLP	0.8797	0.8778	0.8759	0.8672	0.8656	0.8581	0.8581	0.8567	0.8610	0.8656	0.8689	0.8723 (40)
HLP (average)												0.8672
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

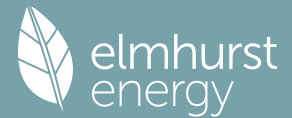
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5477 (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	77.1885	76.0421	74.4278	71.4513	69.2225	66.7512	65.4163	67.0193	68.7647	71.4091	74.4469	76.9275 (42b)
Hot water usage for other uses	40.7206	39.2398	37.7591	36.2783	34.7976	33.3168	33.3168	34.7976	36.2783	37.7591	39.2398	40.7206 (42c)
Average daily hot water use (litres/day)												108.5846 (43)
Daily hot water use	117.9090	115.2819	112.1869	107.7296	104.0201	100.0680	98.7331	101.8169	105.0430	109.1682	113.6867	117.6481 (44)
Energy conte	186.7391	164.1599	172.4270	147.4765	140.0311	123.0453	119.4091	126.0706	129.5286	148.1402	161.9676	184.2085 (45)
Energy content (annual)												Total = $\text{Sum}(45)\text{m} = 1803.2035$
Distribution loss (46)m = $0.15 \times (45)\text{m}$	28.0109	24.6240	25.8641	22.1215	21.0047	18.4568	17.9114	18.9106	19.4293	22.2210	24.2951	27.6313 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034 (56)
If cylinder contains dedicated solar storage	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034 (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	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743 (64)
												Total per year (kWh/year) = $\text{Sum}(64)\text{m} = 2355.0105$ (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) = $\text{Sum}(64a)\text{m} = 0.0000$ (64a)
Heat gains from water heating, kWh/month	99.5834	88.4475	94.8246	85.3191	84.0530	77.1958	77.1962	79.4111	79.3514	86.7493	90.1374	98.7420 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.7739	30.8859	25.1181	19.0160	14.2147	12.0006	12.9671	16.8551	22.6229	28.7250	33.5263	35.7404 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.0593	345.6088	336.6641	317.6221	293.5849	270.9933	255.9007	252.3512	261.2959	280.3379	304.3751	326.9667 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336 (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)	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063 (71)
Water heating gains (Table 5)	133.8486	131.6183	127.4525	118.4988	112.9744	107.2163	103.7583	106.7354	110.2103	116.5985	125.1909	132.7177 (72)

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Total internal gains
617.4686 614.8997 596.0214 561.9236 527.5607 493.9970 476.4129 479.7285 497.9159 532.4482 569.8791 602.2115 (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			
Southeast				2.3000	36.7938	0.6300	0.7000	0.7700	25.8627 (77)			
South				4.5900	46.7521	0.6300	0.7000	0.7700	65.5821 (78)			
West				8.7400	19.6403	0.6300	0.7000	0.7700	52.4603 (80)			
Solar gains	143.9051	254.0838	366.0995	475.8036	546.8679	547.3510	525.9824	473.4040	404.7492	286.3083	174.1266	121.9429 (83)
Total gains	761.3737	868.9835	962.1209	1037.7272	1074.4286	1041.3480	1002.3953	953.1324	902.6651	818.7565	744.0057	724.1544 (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, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.7077	64.8468	64.9838	65.6349	65.7581	66.3382	66.3382	66.4467	66.1135	65.7581	65.5092	65.2510
alpha	5.3138	5.3231	5.3323	5.3757	5.3839	5.4225	5.4225	5.4298	5.4076	5.3839	5.3673	5.3501
util living area	0.9703	0.9428	0.8855	0.7719	0.6140	0.4440	0.3189	0.3498	0.5473	0.8124	0.9434	0.9760 (86)
MIT	20.2070	20.4068	20.6476	20.8607	20.9640	20.9948	20.9993	20.9988	20.9847	20.8458	20.4946	20.1603 (87)
Th 2	20.1848	20.1864	20.1880	20.1954	20.1968	20.2033	20.2033	20.2045	20.2008	20.1968	20.1940	20.1911 (88)
util rest of house	0.9637	0.9312	0.8644	0.7368	0.5671	0.3900	0.2614	0.2897	0.4879	0.7738	0.9299	0.9706 (89)
MIT 2	19.2792	19.5265	19.8162	20.0624	20.1677	20.2002	20.2030	20.2040	20.1907	20.0540	19.6448	19.2260 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	19.6746	19.9017	20.1705	20.4026	20.5071	20.5388	20.5424	20.5428	20.5291	20.3915	20.0070	19.6241 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6746	19.9017	20.1705	20.4026	20.5071	20.5388	20.5424	20.5428	20.5291	20.3915	20.0070	19.6241 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9588	0.9266	0.8639	0.7462	0.5855	0.4129	0.2859	0.3153	0.5126	0.7837	0.9263	0.9660 (94)
Useful gains	729.9943	805.1934	831.1532	774.3606	629.0935	429.9750	286.6274	300.5530	462.7260	641.6442	689.1482	699.5492 (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	1146.8891	1116.6700	1015.4384	845.9305	646.4823	432.1278	286.8591	300.9470	469.3893	718.7398	951.0324	1141.0039 (97)
Space heating kWh	310.1698	209.3123	137.1082	51.5303	12.9373	0.0000	0.0000	0.0000	0.0000	57.3591	188.5566	328.4423 (98a)
Space heating requirement - total per year (kWh/year)	1295.4159											
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	310.1698	209.3123	137.1082	51.5303	12.9373	0.0000	0.0000	0.0000	0.0000	57.3591	188.5566	328.4423 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1295.4159											
Space heating per m ²	(98c) / (4) = 15.2761 (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 %)												219.3000 (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	310.1698	209.3123	137.1082	51.5303	12.9373	0.0000	0.0000	0.0000	0.0000	57.3591	188.5566	328.4423 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	141.4363	95.4456	62.5208	23.4976	5.8994	0.0000	0.0000	0.0000	0.0000	26.1555	85.9811	149.7685 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743 (64)

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Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	122.6916	108.4508	115.1748	101.2765	98.1601	88.4450	87.3293	90.8279	91.8501	102.4191	108.8874	121.3625 (219)	190.4000 (217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	30.4374	24.4180	21.9857	16.1077	12.4420	10.1652	11.3500	14.7532	19.1630	25.1428	28.3988	31.2834 (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												590.7049 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												190.4000	
Water heating fuel used												1236.8753 (219)	
Space cooling fuel												0.0000 (221)	
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000 (231)	
Electricity for lighting (calculated in Appendix L)												245.6473 (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												2073.2274 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	590.7049	16.4900	97.4072 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1236.8753	16.4900	203.9607 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	245.6473	16.4900	40.5072 (250)
Additional standing charges			0.0000 (251)
Total energy cost			341.8752 (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] = 0.9482 (257)
SAP value	84.6298
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	590.7049	0.1574	92.9825 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1236.8753	0.1409	174.2508 (264)
Space and water heating			267.2333 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	245.6473	0.1443	35.4545 (268)
Total CO2, kg/year			302.6878 (272)
CO2 emissions per m2			3.5700 (273)
EI value			96.8752
EI rating			97 (274)
EI band			A

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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	84.8000 (1b)	x 2.4000 (2b)	= 203.5200 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 203.5200 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.0983 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3233 (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) = 0.2748 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.2885	0.2748	0.2748	0.2542	0.2542	0.2267	0.2336	0.2198	0.2267	0.2404	0.2404	0.2610 (22b)
	0.5416	0.5378	0.5378	0.5323	0.5323	0.5257	0.5273	0.5242	0.5257	0.5289	0.5289	0.5341 (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
Door			1.8000	1.0000	1.8000		(26)
Windows (Uw = 1.00)			15.6300	0.9615	15.0288		(27)
Heatloss Floor 1			84.8000	0.1000	8.4800	75.0000	6360.0000 (28a)
Main	54.0240	15.6300	38.3940	0.1800	6.9109	60.0000	2303.6401 (29a)
Wall to Lobby	12.7200	1.8000	10.9200	0.1400	1.5288	60.0000	655.2000 (29a)
Total net area of external elements Aum(A, m ²)			151.5440				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.7486		(33)
Party Wall 1			22.9200	0.0000	0.0000	45.0000	1031.4000 (32)
Party Ceiling 1			84.8000			70.0000	5936.0000 (32b)
Internal Wall 1			121.2000			9.0000	1090.8000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17377.0401 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 204.9179 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	8.7900	0.0500	0.4395
E3 Sill	8.7900	0.0320	0.2813
E4 Jamb	21.2000	0.0350	0.7420
E5 Ground floor (normal)	27.8100	0.0460	1.2793
E16 Corner (normal)	9.6000	0.0420	0.4032
E17 Corner (inverted - internal area greater than external area)	4.8000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.4000	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.3100	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.1452 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 36.8938 (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
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elmhurst
energy

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8640	0.8610	0.8610	0.8567	0.8567	0.8514	0.8527	0.8502	0.8514	0.8540	0.8540	0.8581
HLP (average)												0.8559
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

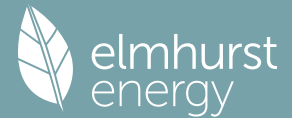
[illegible]5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.7739	30.8859	25.1181	19.0160	14.2147	12.0006	12.9671	16.8551	22.6229	28.7250	33.5263	35.7404	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.0593	345.6088	336.6641	317.6221	293.5849	270.9933	255.9007	252.3512	261.2959	280.3379	304.3751	326.9667	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	(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)	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	(71)
Water heating gains (Table 5)	133.8486	131.6183	127.4525	118.4988	112.9744	107.2163	103.7583	106.7354	110.2103	116.5985	125.1909	132.7177	(72)
Total internal gains	617.4686	614.8997	596.0214	561.9236	527.5607	493.9970	476.4129	479.7285	497.9159	532.4482	569.8791	602.2115	(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

Southeast	2.3000	40.4699	0.6300	0.7000	0.7700	28.4467 (77)
South	4.5900	50.9848	0.6300	0.7000	0.7700	71.5197 (78)
West	8.7400	22.3313	0.6300	0.7000	0.7700	59.6482 (80)

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Solar gains	159.6146	253.6673	361.5001	485.4970	545.2056	584.8243	555.5613	510.0607	433.6160	305.2930	197.8708	133.9471 (83)
Total gains	777.0832	868.5670	957.5215	1047.4206	1072.7663	1078.8214	1031.9742	989.7892	931.5318	837.7412	767.7499	736.1587 (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	65.8790	66.1135	66.1135	66.4467	66.4467	66.8550	66.7569	66.9506	66.8550	66.6561	66.6561	66.3382
alpha	5.3919	5.4076	5.4076	5.4298	5.4298	5.4570	5.4505	5.4634	5.4570	5.4437	5.4437	5.4225
util living area	0.9594	0.9303	0.8588	0.7172	0.5327	0.3341	0.2172	0.2330	0.4464	0.7458	0.9169	0.9668 (86)
MIT	20.3416	20.5032	20.7321	20.9134	20.9847	20.9990	20.9999	20.9999	20.9954	20.9121	20.6264	20.3003 (87)
Th 2	20.1982	20.2008	20.2008	20.2045	20.2045	20.2090	20.2079	20.2100	20.2090	20.2068	20.2068	20.2033 (88)
util rest of house	0.9505	0.9163	0.8335	0.6775	0.4827	0.2815	0.1617	0.1755	0.3869	0.6993	0.8977	0.9593 (89)
MIT 2	19.4577	19.6563	19.9257	20.1259	20.1934	20.2086	20.2079	20.2100	20.2064	20.1312	19.8137	19.4112 (90)
Living area fraction	fLA = Living area / (4) =											0.4262 (91)
MIT	19.8344	20.0172	20.2694	20.4615	20.5306	20.5454	20.5454	20.5466	20.5426	20.4640	20.1600	19.7901 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8344	20.0172	20.2694	20.4615	20.5306	20.5454	20.5454	20.5466	20.5426	20.4640	20.1600	19.7901 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9458	0.9127	0.8359	0.6907	0.5034	0.3039	0.1853	0.2000	0.4121	0.7150	0.8965	0.9547 (94)
Useful gains	734.9473	792.7064	800.3447	723.4558	540.0421	327.8368	191.2672	198.0018	383.8956	598.9583	688.2618	702.7856 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1079.5927	1052.6032	939.5950	767.2303	547.0561	328.1823	191.2832	198.0259	385.7411	641.8920	880.5798	1068.8929 (97)
Space heating kWh	256.4162	174.6507	103.6023	31.5177	5.2184	0.0000	0.0000	0.0000	0.0000	31.9427	138.4689	272.3838 (98a)
Space heating requirement - total per year (kWh/year)												1014.2006
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	256.4162	174.6507	103.6023	31.5177	5.2184	0.0000	0.0000	0.0000	0.0000	31.9427	138.4689	272.3838 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1014.2006
Space heating per m2												(98c) / (4) = 11.9599 (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 %)												219.3000 (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	256.4162	174.6507	103.6023	31.5177	5.2184	0.0000	0.0000	0.0000	0.0000	31.9427	138.4689	272.3838 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	116.9249	79.6401	47.2423	14.3719	2.3796	0.0000	0.0000	0.0000	0.0000	14.5657	63.1413	124.2060 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743 (64)
Efficiency of water heater	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	122.6916	108.4508	115.1748	101.2765	98.1601	88.4450	87.3293	90.8279	91.8501	102.4191	108.8874	121.3625 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.4374	24.4180	21.9857	16.1077	12.4420	10.1652	11.3500	14.7532	19.1630	25.1428	28.3988	31.2834 (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)

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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	(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	(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	(235d)
Annual totals kWh/year											
Space heating fuel - main system 1											462.4718 (211)
Space heating fuel - main system 2											0.0000 (213)
Space heating fuel - secondary											0.0000 (215)
Efficiency of water heater											190.4000
Water heating fuel used											1236.8753 (219)
Space cooling fuel											0.0000 (221)
Electricity for pumps and fans:											
Total electricity for the above, kWh/year											0.0000 (231)
Electricity for lighting (calculated in Appendix L)											245.6473 (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											1944.9943 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	462.4718	17.6200	81.4875 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1236.8753	17.6200	217.9374 (247)
Energy for instantaneous electric shower(s)	0.0000	17.6200	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	245.6473	17.6200	43.2831 (250)
Additional standing charges			0.0000 (251)
Total energy cost			342.7080 (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	462.4718	0.1582	73.1594 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1236.8753	0.1409	174.2508 (264)
Space and water heating			247.4102 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	245.6473	0.1443	35.4545 (268)
Total CO2, kg/year			282.8646 (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	462.4718	1.5856	733.2911 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1236.8753	1.5209	1881.1900 (278)
Space and water heating			2614.4811 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	245.6473	1.5338	376.7820 (282)
Total Primary energy kWh/year			2991.2631 (286)

SAP 10 EPC IMPROVEMENTS

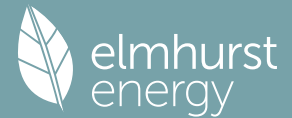
Flat 1

Current energy efficiency rating:	B 85
Current environmental impact rating:	A 97

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings		Energy efficiency	Environmental impact
	Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 85
 Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 2022)
 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	£343	£343	£0
Space heating	£81	£81	£0
Water heating	£218	£218	£0
Lighting	£43	£43	£0
Total cost of fuels	£343	£343	£0
Total cost of uses	£342	£342	£0
Delivered energy	23 kWh/m²	23 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	35 kWh/m²	35 kWh/m²	0 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	84.8000 (1b)	x 2.4000 (2b)	= 203.5200 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 203.5200 (5)

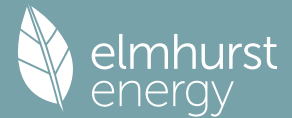
2. Ventilation rate

	m³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.0983 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3233 (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) = 0.2748 (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	0.3503	0.3435	0.3366	0.3023	0.2954	0.2610	0.2610	0.2542	0.2748	0.2954	0.3091	0.3229 (22b)
Effective ac	0.5614	0.5590	0.5567	0.5457	0.5436	0.5341	0.5341	0.5323	0.5378	0.5436	0.5478	0.5521 (25)

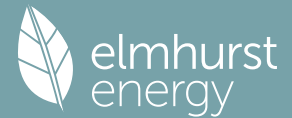
3. Heat losses and heat loss parameter

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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						
Door			1.8000	1.0000	1.8000			(26)					
Windows (Uw = 1.00)			15.6300	0.9615	15.0288			(27)					
Heatloss Floor 1			84.8000	0.1000	8.4800	75.0000	6360.0000	(28a)					
Main	54.0240	15.6300	38.3940	0.1800	6.9109	60.0000	2303.6401	(29a)					
Wall to Lobby	12.7200	1.8000	10.9200	0.1400	1.5288	60.0000	655.2000	(29a)					
Total net area of external elements Aum(A, m2)			151.5440					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.7486			(33)					
Party Wall 1			22.9200	0.0000	0.0000	45.0000	1031.4000	(32)					
Party Ceiling 1			84.8000			70.0000	5936.0000	(32b)					
Internal Wall 1			121.2000			9.0000	1090.8000	(32c)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17377.0401	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							204.9179	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				8.7900	0.0500	0.4395							
E3 Sill				8.7900	0.0320	0.2813							
E4 Jamb				21.2000	0.0350	0.7420							
E5 Ground floor (normal)				27.8100	0.0460	1.2793							
E16 Corner (normal)				9.6000	0.0420	0.4032							
E17 Corner (inverted - internal area greater than external area)				4.8000	0.0000	0.0000							
E17 Corner (inverted - internal area greater than external area)				2.4000	0.0000	0.0000							
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				9.3100	0.0000	0.0000							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.1452	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	36.8938	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 37.7025	Feb 37.5425	Mar 37.3856	Apr 36.6487	May 36.5109	Jun 35.8691	Jul 35.8691	Aug 35.7502	Sep 36.1163	Oct 36.5109	Nov 36.7898	Dec 37.0814	(38)
Heat transfer coeff	74.5964	74.4363	74.2794	73.5425	73.4047	72.7629	72.7629	72.6440	73.0101	73.4047	73.6836	73.9752	(39)
Average = Sum(39)m / 12 =													73.5419
HLP	Jan 0.8797	Feb 0.8778	Mar 0.8759	Apr 0.8672	May 0.8656	Jun 0.8581	Jul 0.8581	Aug 0.8567	Sep 0.8610	Oct 0.8656	Nov 0.8689	Dec 0.8723	(40)
HLP (average)													0.8672
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heating energy requirements (kWh/year)													
Assumed occupancy													
Hot water usage for mixer showers													2.5477 (42)
	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	77.1885	76.0421	74.4278	71.4513	69.2225	66.7512	65.4163	67.0193	68.7647	71.4091	74.4469	76.9275	(42b)
Hot water usage for other uses	40.7206	39.2398	37.7591	36.2783	34.7976	33.3168	33.3168	34.7976	36.2783	37.7591	39.2398	40.7206	(42c)
Average daily hot water use (litres/day)													108.5846 (43)
Daily hot water use	Jan 117.9090	Feb 115.2819	Mar 112.1869	Apr 107.7296	May 104.0201	Jun 100.0680	Jul 98.7331	Aug 101.8169	Sep 105.0430	Oct 109.1682	Nov 113.6867	Dec 117.6481	(44)
Energy conte	186.7391	164.1599	172.4270	147.4765	140.0311	123.0453	119.4091	126.0706	129.5286	148.1402	161.9676	184.2085	(45)
Energy content (annual)										Total = Sum(45)m =			1803.2035
Distribution loss (46)m = 0.15 x (45)m	28.0109	24.6240	25.8641	22.1215	21.0047	18.4568	17.9114	18.9106	19.4293	22.2210	24.2951	27.6313	(46)
Water storage loss:													
Store volume													170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	(56)
If cylinder contains dedicated solar storage	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	(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	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743	(64)
Total per year (kWh/year) = Sum(64)m =													2355.0105 (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	99.5834	88.4475	94.8246	85.3191	84.0530	77.1958	77.1962	79.4111	79.3514	86.7493	90.1374	98.7420	(65)
5. Internal gains (see Table 5 and 5a)													

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	152.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.7739	30.8859	25.1181	19.0160	14.2147	12.0006	12.9671	16.8551	22.6229	28.7250	33.5263	35.7404	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.0593	345.6088	336.6641	317.6221	293.5849	270.9933	255.9007	252.3512	261.2959	280.3379	304.3751	326.9667	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	(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)	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	(71)
Water heating gains (Table 5)	133.8486	131.6183	127.4525	118.4988	112.9744	107.2163	103.7583	106.7354	110.2103	116.5985	125.1909	132.7177	(72)
Total internal gains	617.4686	614.8997	596.0214	561.9236	527.5607	493.9970	476.4129	479.7285	497.9159	532.4482	569.8791	602.2115	(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			

Southeast				2.3000	36.7938	0.6300	0.7000	0.7700	25.8627 (77)			
South				4.5900	46.7521	0.6300	0.7000	0.7700	65.5821 (78)			
West				8.7400	19.6403	0.6300	0.7000	0.7700	52.4603 (80)			

Solar gains	143.9051	254.0838	366.0995	475.8036	546.8679	547.3510	525.9824	473.4040	404.7492	286.3083	174.1266	121.9429 (83)
Total gains	761.3737	868.9835	962.1209	1037.7272	1074.4286	1041.3480	1002.3953	953.1324	902.6651	818.7565	744.0057	724.1544 (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, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	64.7077	64.8468	64.9838	65.6349	65.7581	66.3382	66.3382	66.4467	66.1135	65.7581	65.5092	65.2510		
alpha	5.3138	5.3231	5.3323	5.3757	5.3839	5.4225	5.4225	5.4298	5.4076	5.3839	5.3673	5.3501		
util living area	0.9703	0.9428	0.8855	0.7719	0.6140	0.4440	0.3189	0.3498	0.5473	0.8124	0.9434	0.9760	(86)	
MIT	20.2070	20.4068	20.6476	20.8607	20.9640	20.9948	20.9993	20.9988	20.9847	20.8458	20.4946	20.1603	(87)	
Th 2	20.1848	20.1864	20.1880	20.1954	20.1968	20.2033	20.2033	20.2045	20.2008	20.1968	20.1940	20.1911	(88)	
util rest of house	0.9637	0.9312	0.8644	0.7368	0.5671	0.3900	0.2614	0.2897	0.4879	0.7738	0.9299	0.9706	(89)	
MIT 2	19.2792	19.5265	19.8162	20.0624	20.1677	20.2002	20.2030	20.2040	20.1907	20.0540	19.6448	19.2260	(90)	
Living area fraction									fLA = Living area / (4) =			0.4262	(91)	
MIT	19.6746	19.9017	20.1705	20.4026	20.5071	20.5388	20.5424	20.5428	20.5291	20.3915	20.0070	19.6241	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.6746	19.9017	20.1705	20.4026	20.5071	20.5388	20.5424	20.5428	20.5291	20.3915	20.0070	19.6241	(93)	

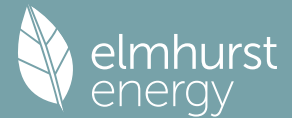
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9588	0.9266	0.8639	0.7462	0.5855	0.4129	0.2859	0.3153	0.5126	0.7837	0.9263	0.9660	(94)
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	1146.8891	1116.6700	1015.4384	845.9305	646.4823	432.1278	286.8591	300.9470	469.3893	718.7398	951.0324	1141.0039	(97)
Space heating kWh	310.1698	209.3123	137.1082	51.5303	12.9373	0.0000	0.0000	0.0000	0.0000	57.3591	188.5566	328.4423	(98a)
Space heating requirement - total per year (kWh/year)												1295.4159	
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	310.1698	209.3123	137.1082	51.5303	12.9373	0.0000	0.0000	0.0000	0.0000	57.3591	188.5566	328.4423	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1295.4159	
Space heating per m2										(98c) / (4) =		15.2761	(99)

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

-----												0.0000 (201)
Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												219.3000 (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	310.1698	209.3123	137.1082	51.5303	12.9373	0.0000	0.0000	0.0000	0.0000	57.3591	188.5566	328.4423 (98)

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Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	141.4363	95.4456	62.5208	23.4976	5.8994	0.0000	0.0000	0.0000	0.0000	26.1555	85.9811	149.7685	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743	(64)
Efficiency of water heater													
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(216)
Fuel for water heating, kWh/month	122.6916	108.4508	115.1748	101.2765	98.1601	88.4450	87.3293	90.8279	91.8501	102.4191	108.8874	121.3625	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	30.4374	24.4180	21.9857	16.1077	12.4420	10.1652	11.3500	14.7532	19.1630	25.1428	28.3988	31.2834	(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												590.7049	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												190.4000	
Water heating fuel used												1236.8753	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.6473	(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												2073.2274	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	590.7049	16.4900	97.4072 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1236.8753	16.4900	203.9607 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	245.6473	16.4900	40.5072 (250)
Additional standing charges			0.0000 (251)
Total energy cost			341.8752 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	0.9482 (257)
SAP value	84.6298
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
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Space heating - main system 1	590.7049	0.1574	92.9825 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1236.8753	0.1409	174.2508 (264)
Space and water heating			267.2333 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	245.6473	0.1443	35.4545 (268)
Total CO2, kg/year			302.6878 (272)
CO2 emissions per m2			3.5700 (273)
EI value			96.8752
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 FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	84.8000 (1b)	x 2.4000 (2b)	= 203.5200 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 203.5200 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.0983 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.5000 (17)
Infiltration rate	0.3233 (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) = 0.2748 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2885	0.2748	0.2748	0.2542	0.2542	0.2267	0.2336	0.2198	0.2267	0.2404	0.2404	0.2610 (22b)
Effective ac	0.5416	0.5378	0.5378	0.5323	0.5323	0.5257	0.5273	0.5242	0.5257	0.5289	0.5289	0.5341 (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
Door			1.8000	1.0000	1.8000		(26)
Windows (Uw = 1.00)			15.6300	0.9615	15.0288		(27)
Heatloss Floor 1			84.8000	0.1000	8.4800	75.0000	6360.0000 (28a)
Main	54.0240	15.6300	38.3940	0.1800	6.9109	60.0000	2303.6401 (29a)
Wall to Lobby	12.7200	1.8000	10.9200	0.1400	1.5288	60.0000	655.2000 (29a)
Total net area of external elements Aum(A, m2)			151.5440				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.7486		(33)
Party Wall 1			22.9200	0.0000	0.0000	45.0000	1031.4000 (32)
Party Ceiling 1			84.8000			70.0000	5936.0000 (32b)
Internal Wall 1			121.2000			9.0000	1090.8000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17377.0401 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							204.9179 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E2 Other lintels (including other steel lintels)	8.7900	0.0500	0.4395
E3 Sill	8.7900	0.0320	0.2813
E4 Jamb	21.2000	0.0350	0.7420
E5 Ground floor (normal)	27.8100	0.0460	1.2793
E16 Corner (normal)	9.6000	0.0420	0.4032
E17 Corner (inverted - internal area greater than external area)	4.8000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.4000	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.3100	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.1452 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	36.8938 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
(38)m	Jan 36.3762	Feb 36.1163	Mar 36.1163
Heat transfer coeff	73.2700	73.0101	73.0101
Average = Sum(39)m / 12 =			72.5814
HLP	Jan 0.8640	Feb 0.8610	Mar 0.8610
HLP (average)			0.8559
Days in mont	31	28	31
			31

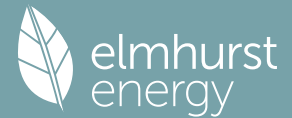
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5477 (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	0.0000 (42a)
Hot water usage for baths	77.1885	76.0421	74.4278	71.4513	69.2225	66.7512	65.4163	67.0193	68.7647	71.4091	74.4469	76.9275	76.9275 (42b)
Hot water usage for other uses	40.7206	39.2398	37.7591	36.2783	34.7976	33.3168	33.3168	34.7976	36.2783	37.7591	39.2398	40.7206	40.7206 (42c)
Average daily hot water use (litres/day)													108.5846 (43)
Daily hot water use	Jan 117.9090	Feb 115.2819	Mar 112.1869	Apr 107.7296	May 104.0201	Jun 100.0680	Jul 98.7331	Aug 101.8169	Sep 105.0430	Oct 109.1682	Nov 113.6867	Dec 117.6481	117.6481 (44)
Energy conte	186.7391	164.1599	172.4270	147.4765	140.0311	123.0453	119.4091	126.0706	129.5286	148.1402	161.9676	184.2085	184.2085 (45)
Energy content (annual)										Total = Sum(45)m =			1803.2035
Distribution loss (46)m = 0.15 x (45)m	28.0109	24.6240	25.8641	22.1215	21.0047	18.4568	17.9114	18.9106	19.4293	22.2210	24.2951	27.6313	27.6313 (46)
Water storage loss:													
Store volume													170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034 (56)
If cylinder contains dedicated solar storage	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034 (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	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	0.0000 (61)
Total heat required for water heating calculated for each month	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743	231.0743 (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	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	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	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	0.0000 (63d)
Output from w/h	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743	231.0743 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	99.5834	88.4475	94.8246	85.3191	84.0530	77.1958	77.1962	79.4111	79.3514	86.7493	90.1374	98.7420	98.7420 (65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan 152.8594	Feb 152.8594	Mar 152.8594	Apr 152.8594	May 152.8594	Jun 152.8594	Jul 152.8594	Aug 152.8594	Sep 152.8594	Oct 152.8594	Nov 152.8594	Dec 152.8594	152.8594 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.7739	30.8859	25.1181	19.0160	14.2147	12.0006	12.9671	16.8551	22.6229	28.7250	33.5263	35.7404	35.7404 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.0593	345.6088	336.6641	317.6221	293.5849	270.9933	255.9007	252.3512	261.2959	280.3379	304.3751	326.9667	326.9667 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336	52.8336 (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	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063	-101.9063 (71)
Water heating gains (Table 5)	133.8486	131.6183	127.4525	118.4988	112.9744	107.2163	103.7583	106.7354	110.2103	116.5985	125.1909	132.7177	132.7177 (72)
Total internal gains	617.4686	614.8997	596.0214	561.9236	527.5607	493.9970	476.4129	479.7285	497.9159	532.4482	569.8791	602.2115	602.2115 (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
Southeast				2.3000	40.4699		0.6300		0.7000		0.7700		28.4467 (77)
South				4.5900	50.9848		0.6300		0.7000		0.7700		71.5197 (78)
West				8.7400	22.3313		0.6300		0.7000		0.7700		59.6482 (80)
Solar gains	159.6146	253.6673	361.5001	485.4970	545.2056	584.8243	555.5613	510.0607	433.6160	305.2930	197.8708	133.9471	(83)
Total gains	777.0832	868.5670	957.5215	1047.4206	1072.7663	1078.8214	1031.9742	989.7892	931.5318	837.7412	767.7499	736.1587	(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	65.8790	66.1135	66.1135	66.4467	66.4467	66.8550	66.7569	66.9506	66.8550	66.6561	66.6561	66.3382	
alpha	5.3919	5.4076	5.4076	5.4298	5.4298	5.4570	5.4505	5.4634	5.4570	5.4437	5.4437	5.4225	
util living area	0.9594	0.9303	0.8588	0.7172	0.5327	0.3341	0.2172	0.2330	0.4464	0.7458	0.9169	0.9668 (86)	
MIT	20.3416	20.5032	20.7321	20.9134	20.9847	20.9990	20.9999	20.9999	20.9954	20.9121	20.6264	20.3003 (87)	
Th 2	20.1982	20.2008	20.2008	20.2045	20.2045	20.2090	20.2079	20.2100	20.2090	20.2068	20.2068	20.2033 (88)	
util rest of house	0.9505	0.9163	0.8335	0.6775	0.4827	0.2815	0.1617	0.1755	0.3869	0.6993	0.8977	0.9593 (89)	
MIT 2	19.4577	19.6563	19.9257	20.1259	20.1934	20.2086	20.2079	20.2100	20.2064	20.1312	19.8137	19.4112 (90)	
Living area fraction									fLA = Living area / (4) =				0.4262 (91)
MIT	19.8344	20.0172	20.2694	20.4615	20.5306	20.5454	20.5454	20.5466	20.5426	20.4640	20.1600	19.7901 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.8344	20.0172	20.2694	20.4615	20.5306	20.5454	20.5454	20.5466	20.5426	20.4640	20.1600	19.7901 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9458	0.9127	0.8359	0.6907	0.5034	0.3039	0.1853	0.2000	0.4121	0.7150	0.8965	0.9547 (94)
Useful gains	734.9473	792.7064	800.3447	723.4558	540.0421	327.8368	191.2672	198.0018	383.8956	598.9583	688.2618	702.7856 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1079.5927	1052.6032	939.5950	767.2303	547.0561	328.1823	191.2832	198.0259	385.7411	641.8920	880.5798	1068.8929 (97)
Space heating kWh	256.4162	174.6507	103.6023	31.5177	5.2184	0.0000	0.0000	0.0000	0.0000	31.9427	138.4689	272.3838 (98a)
Space heating requirement - total per year (kWh/year)												1014.2006
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	256.4162	174.6507	103.6023	31.5177	5.2184	0.0000	0.0000	0.0000	0.0000	31.9427	138.4689	272.3838 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1014.2006
Space heating per m2										(98c) / (4) =		11.9599 (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 %)												219.3000 (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	256.4162	174.6507	103.6023	31.5177	5.2184	0.0000	0.0000	0.0000	0.0000	31.9427	138.4689	272.3838 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	116.9249	79.6401	47.2423	14.3719	2.3796	0.0000	0.0000	0.0000	0.0000	14.5657	63.1413	124.2060 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	233.6049	206.4903	219.2928	192.8305	186.8969	168.3993	166.2749	172.9364	174.8826	195.0060	207.3216	231.0743 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)
Fuel for water heating, kWh/month	122.6916	108.4508	115.1748	101.2765	98.1601	88.4450	87.3293	90.8279	91.8501	102.4191	108.8874	121.3625 (219)

Full SAP Calculation Printout



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	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	30.4374	24.4180	21.9857	16.1077	12.4420	10.1652	11.3500	14.7532	19.1630	25.1428	28.3988	(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	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	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	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												462.4718 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.4000
Water heating fuel used												1236.8753 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												245.6473 (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												1944.9943 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	462.4718	17.6200	81.4875 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1236.8753	17.6200	217.9374 (247)
Energy for instantaneous electric shower(s)	0.0000	17.6200	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	245.6473	17.6200	43.2831 (250)
Additional standing charges			0.0000 (251)
Total energy cost			342.7080 (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	462.4718	0.1582	73.1594 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1236.8753	0.1409	174.2508 (264)
Space and water heating			247.4102 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	245.6473	0.1443	35.4545 (268)
Total CO2, kg/year			282.8646 (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	462.4718	1.5856	733.2911 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1236.8753	1.5209	1881.1900 (278)
Space and water heating			2614.4811 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	245.6473	1.5338	376.7820 (282)
Total Primary energy kWh/year			2991.2631 (286)

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Predicted Energy Assessment



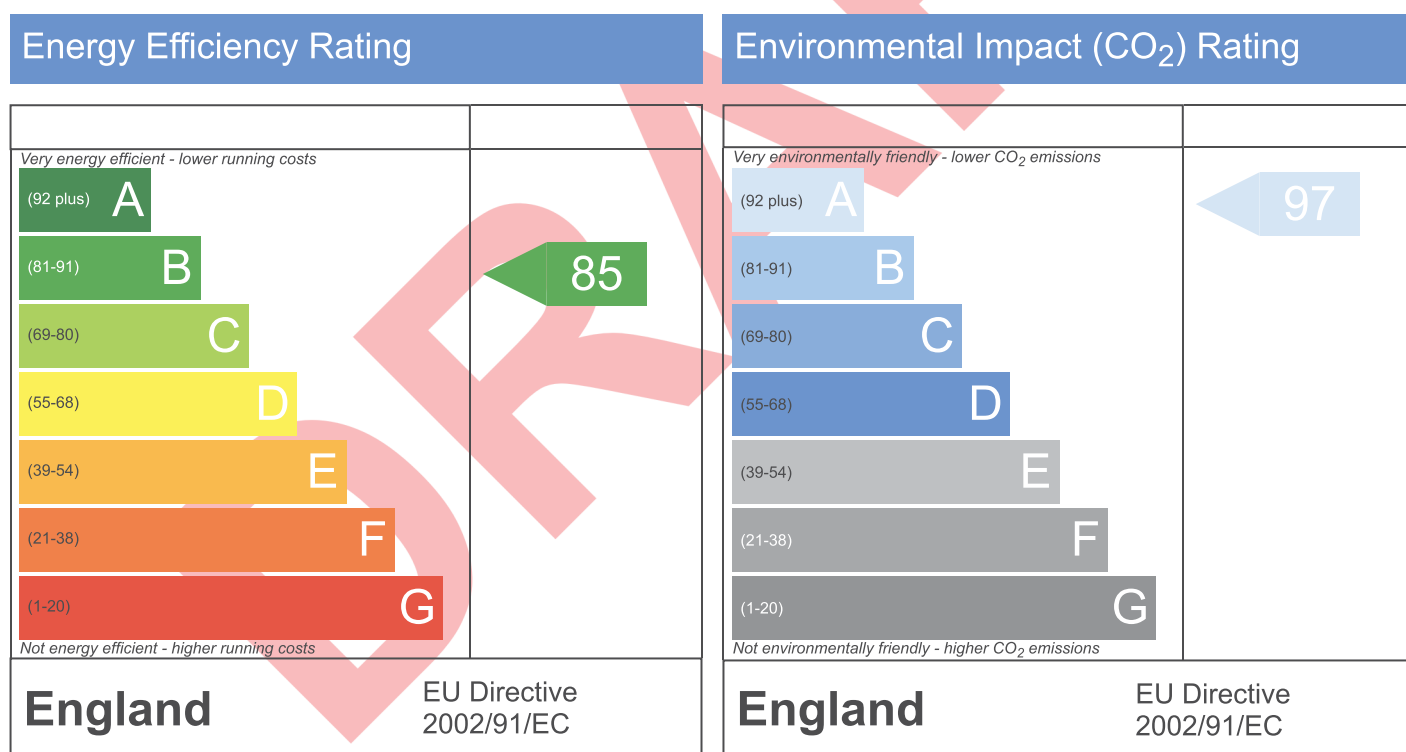
Plot 1, Red Line Land, Reading

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

Flat, Semi-Detached
06/10/2022
Matthew Carter
84.8 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.