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ENERGY & SUSTAINABILITY ASSESSMENT

FOR THE SITE AT

20 WATFORD ROAD

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1. EXECUTIVE SUMMARY

This Sustainability statement has been prepared to support the planning application for the replacement of an existing house and erection of 6 new apartments. The strategy highlights how the proposed development will promote sustainability through both design and operation and summarises the relevant regulatory and planning policies applicable and how the relevant policy targets will be addressed and achieved.

The strategy responds to the UK Planning and regulatory framework, National Planning Policy Framework 2021 and the Draft Hertsmere Local Plan 2021.

In accordance with the Energy Hierarchy detailed within National Planning Policy Framework, this statement outlines an overall commitment to reducing energy consumption under occupancy through the adoption of a 'Fabric First' principle, which will seek enhanced insulation standards and improved heating and lighting efficiencies in comparison to the standard requirements of Approved Document Part L 2021. Further carbon emission reduction can be achieved by using renewables.

Energy Efficiency & Carbon Reduction:

- Passive design principles including a high level of insulation and reduced air permeability to deliver Part L compliant Building in absence of renewable technologies.
- Air Source Heat Pumps & Photovoltaic panels have been proposed for the specific scheme and will deliver a **83%** reduction in regulated carbon emissions over Part L baseline when utilising the proposed carbon factor changes to Building Regulations Part L.

Material and waste management:

- Minimising the use of virgin materials during construction by recycling and reusing where feasible.
- Low waste benchmark levels will be targeted during construction with requirements identifying that the diversion of waste from landfill is to be achieved by the contractor.

Recommendation and Results:

This report demonstrates that the proposed development by incorporating the measures above can achieve an average carbon emission reduction of **83%** with the use of:

- **Air Source Heat Pumps & Photovoltaic panels.**

The following tables demonstrate the carbon emissions and savings.

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

	Regulated Carbon dioxide emissions (Tonnes CO2 per annum)	Total Carbon dioxide emissions (Tonnes CO2 per annum)
Building Regs Notional Development	13.13	15.76
After Energy demand Reduction	16.99	20.38
After CHP	16.99	20.38
After Renewables	2.24	2.69

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

	Regulated Carbon dioxide savings	
	Tonnes CO2 per annum	%
Be Lean: Savings from Energy Demand Reduction	-3.85	-29.3%
Be Clean: Savings from Heat Network	0.00	0.0%
Be Green: Savings from Renewable Energy	14.75	112.3%
Cumulative on-site savings	10.9	83.0%

2. INTRODUCTION

Site description

20 Watford Way involves the replacement of an existing dwelling house and the erection of 6 new flats.

Methodology

This energy assessment outlines the energy demand from the development together with the associated CO₂ emissions, using the present Building Regulations Part L as a baseline. It demonstrates how the emissions from energy use in the development will be reduced through energy efficiency measures.

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

The methodology employed to determine the potential CO₂ savings is in accordance with the three-step Energy Hierarchy.

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

The government approved Standard Assessment Procedure (SAP) methodology software (2021) has been used to determine the CO₂ emissions and energy requirements. It compares CO₂ emissions from regulated energy use (DER) with those of an equivalent dwelling built to Part L 2021 (TER), a notional dwelling of the same size and shape.

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

3. PLANNING POLICY CONTEXT

National Planning Policy Framework 2021

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

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

Draft Hertsmere Local Plan 2021

Policy CC2 - Greenhouse gas reductions

A tiered approach will be applied to secure reductions in greenhouse gas emissions dependent upon the scale of development proposed. Developments that meet one or more of the following criteria are defined as meeting the carbon scheme threshold and will be required to achieve on-site net zero greenhouse gas emissions:

- i. residential - the development of five or more residential units or the site area of 0.5 ha or more;
- ii. non-residential development - the creation of 500m² floorspace or a site area of 1 hectare or above; or
- iii. changes of use and refurbishment projects where planning permission is required - 1,000m²/ site area of 1 hectare or above.

For relevant developments below the carbon scheme threshold, net zero carbon will be sought. Where exceptionally it can be demonstrated that this cannot be practicably achieved on such sites, any residual greenhouse gas / carbon shortfall will need to be monetised and paid into a carbon offset fund.

The carbon offset unit price is per tonne of residual greenhouse gases is established in the council's Carbon Offset Fund Supplementary Planning Document, which will be regularly reviewed thereafter by the council.

Policy CC4 – Natural cooling

Green infrastructure, tree planting schemes, landscape works or green roofs should be integrated as key components of all schemes. Proposals will be expected to include provision for the ongoing management and maintenance of green infrastructure.

4. ENERGY STRATEGY

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

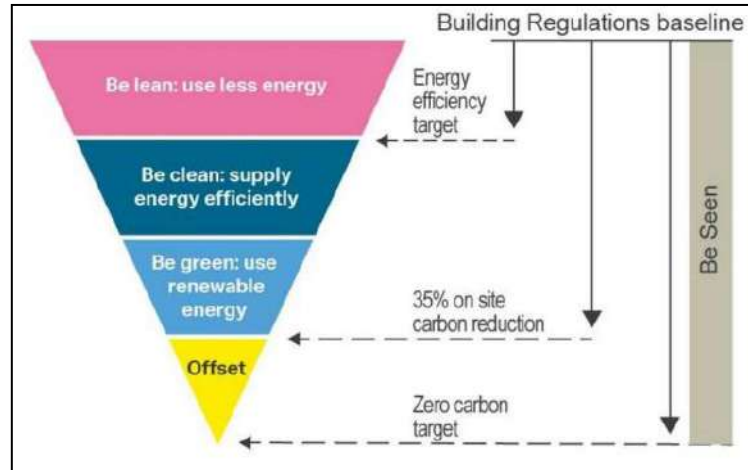


Figure 1. Energy Hierarchy

Be 'Lean' - Demand Reduction

The building fabric performance and engineering systems have been optimised in order to use less energy prior to the inclusion or consideration of Low and Zero Carbon (LZC) Technology. This is ensured through passive design measures, efficient building fabric and engineering systems.

Passive Design Measures:

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

Table 3. Fabric Energy Efficiency Standard

Thermal element	Part L Minimum Standard
Wall	0.18 W/m ² k
Roof	0.11W/m ² k
Floor	0.13 W/m ² k
Glazing	1.2 W/m ² k
Doors	1.2 W/m ² k

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

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

Table 4. Energy Efficient design Specification

Element	Standard	Specification
Wall	0.18 W/m ² k	0.18W/m ² k
Floor	0.13/ Wm ² k	0.14W/m ² k
Roof	0.11W/ m ² k	0.11 W/ m ² k
Glazing	1.2 W/ m ² k	1.2 W/ m ² k

Space Heating & Cooling - Space heating will be provided by air source heatpumps and underfloor heating for the flats

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

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

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

Be 'Clean' – Supply Energy Efficiently

The Be Clean step of the energy hierarchy refers to the use of 'Clean energy supply'. This includes, but is not limited to, the use of Combined Heat and Power (CHP) and District Heat Networks. Policy TP1 seeks for new development to promote the use of CHP and district heating.

District Heating and Cooling

There is no existing or planned heat and energy network in the vicinity and the site does not fall into an opportunity area with decentralised energy potential.

Community heating and Combined Heat and Power (CHP system)

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

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



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



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

Be 'Green' - Renewable Energy

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

Table 5. Renewable Technologies Feasibility Table

Technology	Pros	Cons
<p>Biomass Heating A biomass system designed for wood pellets, which have a high-energy content, would fuel this development.</p> 	<ul style="list-style-type: none"> • Less volume of storage • Less maintenance and produce considerably less ash residue 	<ul style="list-style-type: none"> • Nox Emissions which may impacts • High Costs • Not suitable for the project
<p>Ground Source Heat Pump It circulates a mixture of water and antifreeze around a loop of pipe, called a ground loop, which is buried in the garden. Heat from the ground is absorbed into the fluid and passes through a heat exchanger into the heat pump</p> 	<ul style="list-style-type: none"> • Use all through the year 	<ul style="list-style-type: none"> • High Costs • Not suitable for this project
<p>Air Source Heat Pump They are an efficient and environmentally-friendly way of heating using air drawn freely from the atmosphere. They operate rather like a refrigerator in reverse, absorbing heat from the air into a working fluid which is passed into a compressor where its temperature is increased before it is transferred into the heating and hot water circuits of the building</p>	<ul style="list-style-type: none"> • Can generate less CO₂ than conventional heating systems. • Cheaper • Provides heating and hot water • Less maintenance • Can be used as air-conditioning in the summer 	<ul style="list-style-type: none"> • Needs electricity • Can be noisy
<p>Wind Turbines Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.</p>	<ul style="list-style-type: none"> • Cheaper • Less CO₂ 	<ul style="list-style-type: none"> • Local wind speeds in the area is likely to be below the level generally required

			<p>for investment in large wind turbines.</p> <ul style="list-style-type: none"> • Noise and signal interference. • Detrimental aesthetic impact
<p>Solar Photovoltaic Panels (PV) Photovoltaic panels extract the energy of the sun to generate electricity. They operate most efficiently when oriented to the south and are inclined to about 35 degrees.</p> 		<ul style="list-style-type: none"> • Cheaper • Less CO₂ • No input power in order to generate electricity. 	

Renewable Technologies Feasibility Review Conclusion

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

On review of the above technologies, it has been concluded that the use of air source heatpumps and photovoltaic panels is to be incorporated in the design because it achieves a CO2 percentage reduction of **83.0%**.

Table 6. Photovoltaic Panels

	System size	Pitch	Orientation
20 Watford Way	11 kWp	Horizontal	South facing

5. SUSTAINABLE DESIGN

The proposed project incorporates sustainable design and construction measures capable of mitigating and adapting to climate change to meet future needs. This section details site-specific initiatives which demonstrate how the conversion helps to meet the sustainability objectives set out in the National Planning Framework 2021.

Energy Use and Pollution

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

Pollution: Air, Noise and Light

The layout of the development can provide good internal air quality for habitable areas but not too much so as to waste heat. The use of openable windows will create horizontal airflow. By achieving a good naturally ventilated building the energy demand for air conditioning and mechanical ventilation will thereby be eliminated within the development.

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

Other measures will include:

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

Light pollution can best be described as artificial light that is allowed to illuminate or intrude upon areas not intended to be lit. Light in the wrong place at the wrong time can be intrusive.

Intrusive light is over bright or poorly directed lights shining onto neighbouring property which affect the neighbours' right to enjoy their property. Therefore, the proposal will incorporate lighting measures in order to avoid causing a nuisance.

Water: Water Efficiency

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

Table 7. Water Fittings Standards

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

Pollution

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

Waste

A space for reuse and recycling will be included at the ground floor unit for the resident's exclusive use.

Flood Risk

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

Biodiversity

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

6. CIRCULAR ECONOMY

Materials efficiency

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

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

Other measures will be implemented:

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

Resource efficiency

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

Diversion of waste from landfill

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

7. CONCLUSION

The development has been designed to exceed Part L building regulations requirements. In line with the national and local policies, regulated CO₂ emissions from the development will be reduced by **83%** from the notional emissions once energy efficiency measures and lean and green measures are taken into account. The cash in lieu contribution for carbon offsetting is estimated at **£6,384**.

In order to achieve the required carbon emissions reduction, the report concludes and proposes the use of energy efficient measures and renewable technologies outlined in the section 4 of this report.

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

8. APPENDIX

I. SAP Calculations

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:03

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	238 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 1 - Boiler
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	12.19 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	15.34 kgCO ₂ /m ²		FAIL
1b Target primary energy rate and dwelling primary energy			
Target primary energy	64.38 kWh _{PE} /m ²		
Dwelling primary energy	84.61 kWh _{PE} /m ²		FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	50.8 kWh/m ²		
Dwelling fabric energy efficiency	49.7 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.14	Heatloss Floor 1 (0.14)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	NORTH (1.2)	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)	95.51	0.18
Sheltered wall: Walls (2)	50.54	0.18
Sheltered wall: Walls (3)	40.86	0.18
Ground floor: Heatloss Floor 1, Heatloss Floor 1	237.83	0.14
Exposed roof: Roof (1)	69.58	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
NORTH, Windows	35.47	North	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	South	N/A	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E22: Basement floor	Calculated by person with suitable expertise	0.07	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	

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	3 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

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

Efficiency	84.2%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Regular boiler
Manufacturer	Vaillant
Model	ecoFIT pure 630
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	500 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

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

Efficiency	
Manufacturer	
Model	

6 Controls

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

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

7 Lighting

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 1 - Boiler	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	83 B	DER	15.34	TER	12.19
Environmental	83 B	% DER < TER			-25.84
CO ₂ Emissions (t/year)	3.44	DFEE	49.72	TFEE	50.82
Compliance Check	See BREL	% DFEE < TFEE			2.16
% DPER < TPER	-31.43	DPER	84.61	TPER	64.38

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	Flat, Detached	
Position of Flat	Basement flat	
Which Floor	0	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	237.83 m ²	3.02 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

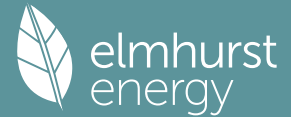
8.0 Living Area	45.59	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	130.98	95.51	0.00	None	35.47	Enter Gross Area	
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	53.45	50.54	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area	
GARAGE WALL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	40.86	40.86	0.30	Garage Double 3 Inside	0.00	Enter Gross Area	

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	69.58	0.00	None	0.00	Enter Gross Area	0.00	

10.1 Party Ceilings	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	168.25	

Summary for Input Data



11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.14	None	0.00	110.00	237.83

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
NORTH	Windows	EXTERNAL	North	35.47	0
ENTRANCE DOOR	Entrance Door	HALLWAY	South	2.91	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	12.63	0.30	0.30	No
E3 Sill	Independently assessed	1.10	0.04	0.04	No
E4 Jamb	Independently assessed	39.50	0.05	0.05	No
E5 Ground floor (normal)	Independently assessed	59.43	0.16	0.16	No
E22 Basement floor	Independently assessed	15.17	0.07	0.07	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	3.15	0.07	0.07	No
E14 Flat roof	Independently assessed	39.59	0.04	0.04	No
E16 Corner (normal)	Independently assessed	24.16	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	18.12	-0.09	-0.09	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP ₅₀	<input type="text" value="Yes"/>	
Designed AP ₅₀	<input type="text" value="3.00"/>	m³/(h.m²) @ 50 Pa
Property Tested?	<input type="text" value="Yes"/>	
Test Method	<input type="text" value="Blower Door"/>	
As Built AP ₅₀	<input type="text" value="0.10"/>	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation	
Mechanical Ventilation System Present	<input type="text" value="Yes"/>
Approved Installation	<input type="text" value="No"/>
Mechanical Ventilation data Type	<input type="text" value="Database"/>
Type	<input type="text" value="Mechanical extract ventilation - centralised"/>
MV Reference Number	<input type="text" value="500808"/>
Configuration	<input type="text" value="4"/>
Manufacturer SFP	<input type="text" value="0.18"/>
Duct Type	<input type="text" value="Rigid"/>
MVHR Efficiency	<input type="text" value="0.00"/>
Wet Rooms	<input type="text" value="4"/>
SFP from Installer Commissioning Certificate	<input type="text" value="No"/>

20.0 Fans, Open Fireplaces, Flues

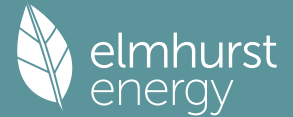
21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting	<input type="text" value="No"/>				
Name	Efficacy	Power	Capacity	Count	
Lighting 1	100.00	10	1000	37	

24.0 Main Heating 1

Summary for Input Data



Percentage of Heat	<input type="text" value="100.00"/>	%
Database Ref. No.	<input type="text" value="17972"/>	
Fuel Type	<input type="text" value="Mains gas"/>	
SAP Code	<input type="text" value="0"/>	
In Winter	<input type="text" value="89.20"/>	
In Summer	<input type="text" value="80.20"/>	
Model Name	<input type="text" value="ecoFIT pure 630"/>	
Manufacturer	<input type="text" value="Vaillant"/>	
System Type	<input type="text" value="Regular boiler"/>	
Controls SAP Code	<input type="text" value="2110"/>	
Delayed Start Stat	<input type="text" value="No"/>	
Burner Control	<input type="text" value="Modulating"/>	
HETAS approved System	<input type="text" value="No"/>	
Oil Pump Inside	<input type="text" value="No"/>	
FI Case	<input type="text" value="0.00"/>	
Flue Type	<input type="text" value="Balanced"/>	
Fan Assisted Flue	<input type="text" value="Yes"/>	
Is MHS Pumped	<input type="text" value="Pump in heated space"/>	
Heating Pump Age	<input type="text" value="2013 or later"/>	
Heat Emitter	<input type="text" value="Radiators and Underfloor"/>	
Underfloor Heating	<input type="text" value="Yes - Pipes in thin screed"/>	
Flow Temperature	<input type="text" value="Unknown"/>	
Boiler Interlock	<input type="text" value="No"/>	
Combi boiler type	<input type="text" value="No Combi"/>	
Combi keep hot type	<input type="text" value="None"/>	
<hr/>		
25.0 Main Heating 2	<input type="text" value="None"/>	
<hr/>		
26.0 Heat Networks	<input type="text" value="None"/>	
<hr/>		
28.0 Water Heating		
Water Heating	<input type="text" value="Main Heating 1"/>	
SAP Code	<input type="text" value="901"/>	
Flue Gas Heat Recovery System	<input type="text" value="No"/>	
Waste Water Heat Recovery Instantaneous System 1	<input type="text" value="No"/>	
Waste Water Heat Recovery Instantaneous System 2	<input type="text" value="No"/>	
Waste Water Heat Recovery Storage System	<input type="text" value="No"/>	
Solar Panel	<input type="text" value="No"/>	
Water use <= 125 litres/person/day	<input type="text" value="No"/>	
Summer Immersion	<input type="text" value="No"/>	
Cold Water Source	<input type="text" value="From mains"/>	
Bath Count	<input type="text" value="2"/>	
Supplementary Immersion	<input type="text" value="No"/>	
Immersion Only Heating Hot Water	<input type="text" value="No"/>	
<hr/>		
28.1 Showers		
Description	Shower Type	Flow Rate [l/min] Rated Power [kW] Connected Connected To
SHOWER	Vented hot water system	7.00 No No
<hr/>		
28.3 Waste Water Heat Recovery System		
<hr/>		
29.0 Hot Water Cylinder	<input type="text" value="Hot Water Cylinder"/>	
Cylinder Stat	<input type="text" value="Yes"/>	

Summary for Input Data



Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Foam
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No
31.0 Thermal Store	None

Recommendations

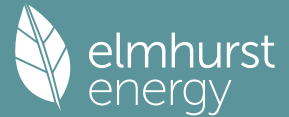
Lower cost measures

None

Further measures to achieve even higher standards

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

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 1 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	83 B	DER	15.34	TER	12.19
Environmental	83 B	% DER < TER			-25.84
CO ₂ Emissions (t/year)	3.44	DFEE	49.72	TFEE	50.82
Compliance Check	See BREL	% DFEE < TFEE			2.16
% DPER < TPER	-31.43	DPER	84.61	TPER	64.38
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	237.8300 (1b)	3.0200 (2b)	718.2466 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	237.8300		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 718.2466 (5)

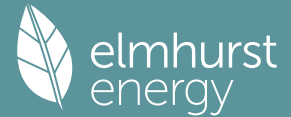
2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)
Wind speed	Jan 5.1000, Feb 5.0000, Mar 4.9000, Apr 4.4000, May 4.3000, Jun 3.8000, Jul 3.8000, Aug 3.7000, Sep 4.0000, Oct 4.3000, Nov 4.5000, Dec 4.7000	(22)
Wind factor	Jan 1.2750, Feb 1.2500, Mar 1.2250, Apr 1.1000, May 1.0750, Jun 0.9500, Jul 0.9500, Aug 0.9250, Sep 1.0000, Oct 1.0750, Nov 1.1250, Dec 1.1750	(22a)
Adj infilt rate	Jan 0.1912, Feb 0.1875, Mar 0.1837, Apr 0.1650, May 0.1612, Jun 0.1425, Jul 0.1425, Aug 0.1388, Sep 0.1500, Oct 0.1612, Nov 0.1687, Dec 0.1762	(22b)
Mechanical extract ventilation - centralised		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
Effective ac	Jan 0.5000, Feb 0.5000, Mar 0.5000, Apr 0.5000, May 0.5000, Jun 0.5000, Jul 0.5000, Aug 0.5000, Sep 0.5000, Oct 0.5000, Nov 0.5000, Dec 0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			35.4700	1.1450	40.6145		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
Heatloss Floor 1			237.8300	0.1400	33.2962	110.0000	26161.3000 (28a)
EXTERNAL	130.9800	35.4700	95.5100	0.1800	17.1918	70.0000	6685.7000 (29a)

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HALLWAY	53.4500	2.9100	50.5400	0.1700	8.5918	70.0000	3537.8000 (29a)
GARAGE WALL	40.8600		40.8600	0.1700	6.9462	70.0000	2860.2000 (29a)
Flat Roof	69.5800		69.5800	0.1100	7.6538	9.0000	626.2200 (30)
Total net area of external elements Aum(A, m2)			532.7000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	117.7863			(33)
Party Ceiling 1			168.2500			30.0000	5047.5000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 44918.7200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 188.8690 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.6300	0.3000	3.7890
E3 Sill	1.1000	0.0400	0.0440
E4 Jamb	39.5000	0.0500	1.9750
E5 Ground floor (normal)	59.4300	0.1600	9.5088
E22 Basement floor	15.1700	0.0700	1.0619
E7 Party floor between dwellings (in blocks of flats)	3.1500	0.0700	0.2205
E14 Flat roof	39.5900	0.0400	1.5836
E16 Corner (normal)	24.1600	0.0900	2.1744
E17 Corner (inverted - internal area greater than external area)	18.1200	-0.0900	-1.6308

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.7264 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 136.5127 (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	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107 (38)
Heat transfer coeff	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234 (39)
Average = Sum(39)m / 12 =												255.0234

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723 (40)
HLP (average)												1.0723
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.0511 (42)
Hot water usage for mixer showers	75.3769	74.2442	72.5935	69.4353	67.1045	64.5054	63.0280	64.6662	66.4619	69.2526	72.4787	75.0881 (42a)
Hot water usage for baths	34.2503	33.7416	33.0253	31.7046	30.7156	29.6190	29.0267	29.7380	30.5125	31.6859	33.0338	34.1345 (42b)
Hot water usage for other uses	48.2910	46.5349	44.7789	43.0229	41.2668	39.5108	39.5108	41.2668	43.0229	44.7789	46.5349	48.2910 (42c)
Average daily hot water use (litres/day)												145.1513 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	157.9182	154.5207	150.3977	144.1627	139.0870	133.6352	131.5655	135.6710	139.9972	145.7174	152.0474	157.5136 (44)
Energy conte	250.1038	220.0354	231.1557	197.3515	187.2378	164.3200	159.1170	167.9890	172.6306	197.7371	216.6195	246.6282 (45)
Energy content (annual)												Total = Sum(45)m = 2410.9256

Distribution loss (46)m = 0.15 x (45)m
 37.5156 33.0053 34.6734 29.6027 28.0857 24.6480 23.8676 25.1983 25.8946 29.6606 32.4929 36.9942 (46)

Water storage loss:
 Store volume 500.0000 (47)

b) If manufacturer declared loss factor is not known :
 Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
 Volume factor from Table 2a 0.6214 (52)
 Temperature factor from Table 2b 0.5400 (53)
 Enter (49) or (54) in (55) 1.9376 (55)

Total storage loss
 60.0650 54.2523 60.0650 58.1274 60.0650 58.1274 60.0650 60.0650 58.1274 60.0650 58.1274 60.0650 (56)

If cylinder contains dedicated solar storage
 60.0650 54.2523 60.0650 58.1274 60.0650 58.1274 60.0650 60.0650 58.1274 60.0650 58.1274 60.0650 (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
 333.4312 295.2989 314.4831 277.9909 270.5652 244.9595 242.4444 251.3164 253.2700 281.0645 297.2589 329.9556 (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 (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)
 FGHS 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
 333.4312 295.2989 314.4831 277.9909 270.5652 244.9595 242.4444 251.3164 253.2700 281.0645 297.2589 329.9556 (64)
 Total per year (kWh/year) = Sum(64)m = 3392.0388 (64) 3392 (64)

12Total per year (kWh/year)
 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
 149.8215 133.3726 143.5212 130.1309 128.9185 119.1480 119.5683 122.5183 121.9112 132.4095 136.5375 148.6658 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts												
(66)m	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554 (66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	216.5819	239.7871	216.5819	223.8013	216.5819	223.8013	216.5819	223.8013	216.5819	223.8013	216.5819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.7149	409.9249	399.3157	376.7300	348.2196	321.4238	303.5226	299.3126	309.9218	332.5075	361.0179	387.8137 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444 (71)
Water heating gains (Table 5)	201.3729	198.4711	192.9048	180.7374	173.2776	165.4833	160.7101	164.6751	169.3211	177.9698	189.6354	199.8197 (72)
Total internal gains	895.4363	919.9497	880.5691	853.0353	809.8457	779.4750	749.5813	749.3362	771.8108	798.8258	846.2212	875.9818 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	35.4700	10.6334	0.6300	0.7000	0.7700	115.2670 (74)						
Solar gains	115.2670	220.2811	374.3114	601.2400	809.9254	867.0491	809.5011	642.2359	450.0436	262.2158	142.1966	96.0922 (83)
Total gains	1010.7033	1140.2308	1254.8804	1454.2754	1619.7710	1646.5241	1559.0824	1391.5721	1221.8544	1061.0416	988.4179	972.0740 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, n1,m (see Table 9a)	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266
tau	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618
util living area	0.9983	0.9969	0.9934	0.9782	0.9279	0.8064	0.6594	0.7352	0.9243	0.9878	0.9969	0.9986 (86)
MIT	19.5413	19.6610	19.8819	20.2180	20.5569	20.7976	20.8873	20.8635	20.6586	20.2433	19.8358	19.5141 (87)
Th 2	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235 (88)
util rest of house	0.9979	0.9961	0.9914	0.9709	0.9014	0.7335	0.5381	0.6200	0.8849	0.9826	0.9959	0.9982 (89)
MIT 2	18.2878	18.4412	18.7238	19.1506	19.5678	19.8345	19.9118	19.8969	19.6954	19.1858	18.6653	18.2529 (90)
Living area fraction	18.5281	18.6750	18.9458	19.3552	19.7574	20.0191	20.0988	20.0822	19.8801	19.3885	18.8897	18.4947 (92)
MIT	18.5281	18.6750	18.9458	19.3552	19.7574	20.0191	20.0988	20.0822	19.8801	19.3885	18.8897	18.4947 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5281	18.6750	18.9458	19.3552	19.7574	20.0191	20.0988	20.0822	19.8801	19.3885	18.8897	18.4947 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9969	0.9944	0.9883	0.9642	0.8924	0.7332	0.5484	0.6278	0.8774	0.9778	0.9941	0.9974 (94)
Useful gains	1007.5582	1133.8467	1240.2282	1402.2116	1445.5161	1207.1814	854.9230	873.6640	1072.1039	1037.5064	982.6098	969.5217 (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	3628.4920	3512.9450	3173.9644	2666.3295	2054.8245	1382.0062	892.2816	939.0424	1474.0571	2241.2700	3006.6500	3645.4752 (97)
Space heating kWh	1949.9748	1598.7541	1438.6998	910.1649	453.3255	0.0000	0.0000	0.0000	0.0000	895.6001	1457.3089	1990.9094 (98a)
Space heating requirement - total per year (kWh/year)												10694.7374
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	1949.9748	1598.7541	1438.6998	910.1649	453.3255	0.0000	0.0000	0.0000	0.0000	895.6001	1457.3089	1990.9094 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10694.7374
Space heating per m2										(98c) / (4) =		44.9680 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												84.2000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	1949.9748	1598.7541	1438.6998	910.1649	453.3255	0.0000	0.0000	0.0000	0.0000	895.6001	1457.3089	1990.9094 (98)
Space heating efficiency (main heating system 1)	84.2000	84.2000	84.2000	84.2000	84.2000	0.0000	0.0000	0.0000	0.0000	84.2000	84.2000	84.2000 (210)
Space heating fuel (main heating system)	2315.8845	1898.7578	1708.6696	1080.9560	538.3913	0.0000	0.0000	0.0000	0.0000	1063.6581	1730.7707	2364.5005 (211)
Space heating efficiency (main heating system 2)												

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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	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating 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	0.0000	(215)
Efficiency of water heater (217)m	333.4312	295.2989	314.4831	277.9909	270.5652	244.9595	242.4444	251.3164	253.2700	281.0645	297.2589	329.9556	80.2000	(64)
Fuel for water heating, kWh/month	82.7619	82.6662	82.4399	81.9179	80.6092	75.2000	75.2000	75.2000	75.2000	81.8714	82.5358	82.7992	82.2000	(216)
Space cooling fuel requirement (221)m	402.8802	357.2185	381.4697	339.3531	335.6504	325.7440	322.3995	334.1974	336.7952	343.3001	360.1577	398.5008	0.0000	(219)
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	0.0000	(221)
Lighting	26.0585	23.5367	26.0585	25.2179	26.0585	25.2179	26.0585	26.0585	25.2179	26.0585	25.2179	26.0585	26.0585	(231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	41.8741	33.5930	30.2467	22.1600	17.1171	13.9848	15.6148	20.2966	26.3633	34.5901	39.0695	43.0379	43.0379	(232)
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	0.0000	(233a)
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	0.0000	(234a)
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	0.0000	(235a)
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	0.0000	(235b)
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	0.0000	(235c)
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	0.0000	(233b)
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	0.0000	(234b)
Annual totals 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	0.0000	(235b)
Space heating fuel - main system 1														12701.5884 (211)
Space heating fuel - main system 2														0.0000 (213)
Space heating fuel - secondary														0.0000 (215)
Efficiency of water heater														80.2000
Water heating fuel used														4237.6667 (219)
Space cooling fuel														0.0000 (221)
Electricity for pumps and fans:														
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)														
mechanical ventilation fans (SFP = 0.2520)														220.8177 (230a)
central heating pump														41.0000 (230c)
main heating flue fan														45.0000 (230e)
Total electricity for the above, kWh/year														306.8177 (231)
Electricity for lighting (calculated in Appendix L)														337.9479 (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														17584.0208 (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	12701.5884	0.2100	2667.3336 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	4237.6667	0.2100	889.9100 (264)
Space and water heating			3557.2436 (265)
Pumps, fans and electric keep-hot	306.8177	0.1387	42.5594 (267)
Energy for lighting	337.9479	0.1443	48.7763 (268)
Total CO2, kg/year			3648.5793 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.3400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	12701.5884	1.1300	14352.7949 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4237.6667	1.1300	4788.5634 (278)
Space and water heating			19141.3583 (279)
Pumps, fans and electric keep-hot	306.8177	1.5128	464.1539 (281)
Energy for lighting	337.9479	1.5338	518.3558 (282)
Total Primary energy kWh/year			20123.8680 (286)
Dwelling Primary energy Rate (DPER)			84.6100 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	x	Storey height (m)	=	Volume (m ³)
Ground floor	237.8300 (1b)		3.0200 (2b)		718.2466 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	237.8300				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 718.2466 (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		4 * 10 =	40.0000 (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) =		40.0000 / (5) =	0.0557 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3057 (18)
Number of sides sheltered			0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3057 (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												
Effective ac	0.3898	0.3821	0.3745	0.3363	0.3286	0.2904	0.2904	0.2828	0.3057	0.3286	0.3439	0.3592 (22b)
	0.5760	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (U _w = 1.20)			35.4700	1.1450	40.6145		(27)
Heatloss Floor 1			237.8300	0.1300	30.9179		(28a)
EXTERNAL	130.9800	35.4700	95.5100	0.1800	17.1918		(29a)
HALLWAY	53.4500	2.9100	50.5400	0.1800	9.0972		(29a)
GARAGE WALL	40.8600		40.8600	0.1800	7.3548		(29a)
Flat Roof	69.5800		69.5800	0.1100	7.6538		(30)
Total net area of external elements A _{um} (A, m ²)			532.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	115.7400	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 195.9434 (35)

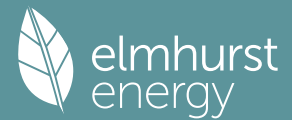
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.6300	0.0500	0.6315
E3 Sill	1.1000	0.0500	0.0550
E4 Jamb	39.5000	0.0500	1.9750
E5 Ground floor (normal)	59.4300	0.1600	9.5088
E22 Basement floor	15.1700	0.0700	1.0619
E7 Party floor between dwellings (in blocks of flats)	3.1500	0.0700	0.2205
E14 Flat roof	39.5900	0.0800	3.1672
E16 Corner (normal)	24.1600	0.0900	2.1744
E17 Corner (inverted - internal area greater than external area)	18.1200	-0.0900	-1.6308
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.1635 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 132.9035 (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	136.5136	135.8146	135.1293	131.9108	131.3086	128.5054	128.5054	127.9863	129.5852	131.3086	132.5268	133.8004 (38)
Heat transfer coeff	269.4171	268.7181	268.0328	264.8143	264.2121	261.4089	261.4089	260.8898	262.4887	264.2121	265.4303	266.7039 (39)

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Average = Sum(39)m / 12 =												264.8114
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1328	1.1299	1.1270	1.1135	1.1109	1.0991	1.0991	1.0970	1.1037	1.1109	1.1161	1.1214 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.1134
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0511 (42)
Hot water usage for mixer showers	75.3769	74.2442	72.5935	69.4353	67.1045	64.5054	63.0280	64.6662	66.4619	69.2526	72.4787	75.0881 (42a)
Hot water usage for baths	32.5378	32.0545	31.3740	30.1193	29.1798	28.1381	27.5754	28.2511	28.9868	30.1016	31.3821	32.4278 (42b)
Hot water usage for other uses	45.8764	44.2082	42.5399	40.8717	39.2035	37.5352	37.5352	39.2035	40.8717	42.5399	44.2082	45.8764 (42c)
Average daily hot water use (litres/day)												141.3685 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	153.7911	150.5069	146.5075	140.4263	135.4879	130.1787	128.1386	132.1207	136.3204	141.8941	148.0690	153.3923 (44)
Energy content (annual)	243.5675	214.3198	225.1766	192.2366	182.3927	160.0699	154.9725	163.5931	168.0967	192.5490	210.9514	240.1753 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2348.1012
Water storage loss:	36.5351	32.1480	33.7765	28.8355	27.3589	24.0105	23.2459	24.5390	25.2145	28.8824	31.6427	36.0263 (46)
Store volume												500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.9009 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.5665 (55)
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (56)
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (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	315.3907	279.1923	296.9997	261.7428	254.2158	229.5761	226.7956	235.4162	237.6030	264.3721	280.4577	311.9984 (62)
WWHRS	-34.4592	-30.4760	-31.9127	-26.4250	-24.6271	-21.0736	-19.7532	-21.0055	-21.8036	-25.7040	-29.1195	-33.8211 (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	280.9315	248.7163	265.0870	235.3179	229.5887	208.5025	207.0425	214.4107	215.7994	238.6681	251.3382	278.1774 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2873.5800 (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	138.4447	123.1593	132.3297	119.5237	118.1041	108.8282	108.9869	111.8532	111.4972	121.4810	125.7463	137.3168 (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	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	216.5819	239.7871	216.5819	223.8013	216.5819	223.8013	216.5819	216.5819	223.8013	216.5819	223.8013	216.5819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.7149	409.9249	399.3157	376.7300	348.2196	321.4238	303.5226	299.3126	309.9218	332.5075	361.0179	387.8137 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555 (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)	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444 (71)
Water heating gains (Table 5)	186.0816	183.2728	177.8625	166.0051	158.7420	151.1503	146.4877	150.3403	154.8572	163.2810	174.6477	184.5656 (72)
Total internal gains	880.1450	904.7514	865.5267	838.3030	795.3101	765.1421	735.3588	735.0014	757.3468	784.1370	831.2335	860.7277 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
North	35.4700	10.6334	0.6300	0.7000	0.7700	115.2670 (74)						
Solar gains	115.2670	220.2811	374.3114	601.2400	809.9254	867.0491	809.5011	642.2359	450.0436	262.2158	142.1966	96.0922 (83)
Total gains	995.4119	1125.0325	1239.8381	1439.5430	1605.2355	1632.1912	1544.8600	1377.2373	1207.3904	1046.3528	973.4301	956.8200 (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 _{11,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.0474	48.1724	48.2955	48.8825	48.9939	49.5193	49.5193	49.6178	49.3156	48.9939	48.7690	48.5362
alpha	4.2032	4.2115	4.2197	4.2588	4.2663	4.3013	4.3013	4.3079	4.2877	4.2663	4.2513	4.2357
util living area	0.9986	0.9975	0.9945	0.9815	0.9369	0.8213	0.6769	0.7519	0.9336	0.9899	0.9974	0.9989 (86)
MIT	19.0871	19.2503	19.5501	20.0182	20.4773	20.8171	20.9426	20.9095	20.6244	20.0612	19.5109	19.0715 (87)
Th 2	19.9741	19.9765	19.9788	19.9899	19.9919	20.0015	20.0015	20.0033	19.9978	19.9919	19.9877	19.9834 (88)
util rest of house	0.9982	0.9967	0.9928	0.9749	0.9120	0.7484	0.5516	0.6344	0.8963	0.9853	0.9966	0.9985 (89)
MIT 2	17.7128	17.9234	18.3088	18.9115	19.4804	19.8671	19.9754	19.9565	19.6695	18.9713	18.2652	17.6989 (90)
Living area fraction	17.9763	18.1778	18.5467	19.1237	19.6715	20.0493	20.1608	20.1392	19.8525	19.1802	18.5040	17.9621 (91)
MIT	17.9763	18.1778	18.5467	19.1237	19.6715	20.0493	20.1608	20.1392	19.8525	19.1802	18.5040	17.9621 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9763	18.1778	18.5467	19.1237	19.6715	20.0493	20.1608	20.1392	19.8525	19.1802	18.5040	17.9621 (93)

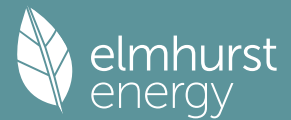
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9970	0.9947	0.9891	0.9670	0.9019	0.7524	0.5735	0.6526	0.8892	0.9798	0.9945	0.9975 (94)
Useful gains	992.4424	1119.0528	1226.2920	1392.0752	1447.7112	1228.1033	885.9005	898.8078	1073.6519	1025.1793	968.1053	954.4384 (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	3684.6214	3567.9759	3228.9129	2707.3795	2106.1727	1424.4835	930.8224	975.5146	1509.9732	2266.9943	3026.9763	3670.3954 (97)
Space heating kWh	2002.9811	1645.6763	1489.9500	947.0191	489.8954	0.0000	0.0000	0.0000	0.0000	923.9104	1482.3872	2020.6720 (98a)
Space heating requirement - total per year (kWh/year)												11002.4915
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	2002.9811	1645.6763	1489.9500	947.0191	489.8954	0.0000	0.0000	0.0000	0.0000	923.9104	1482.3872	2020.6720 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11002.4915
Space heating per m ²												(98c) / (4) = 46.2620 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2002.9811	1645.6763	1489.9500	947.0191	489.8954	0.0000	0.0000	0.0000	0.0000	923.9104	1482.3872	2020.6720 (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)	2170.0771	1782.9646	1614.2470	1026.0229	530.7642	0.0000	0.0000	0.0000	0.0000	1000.9863	1606.0533	2189.2438 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	280.9315	248.7163	265.0870	235.3179	229.5887	208.5025	207.0425	214.4107	215.7994	238.6681	251.3382	278.1774 (64)
Efficiency of water heater (217)m	87.5850	87.5043	87.3126	86.8505	85.7152	79.8000	79.8000	79.8000	79.8000	86.7905	87.3715	79.8000 (216)
Fuel for water heating, kWh/month	320.7531	284.2332	303.6067	270.9459	267.8506	261.2813	259.4517	268.6851	270.4253	274.9933	287.6662	317.5380 (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 (234a)m	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 (235a)m	45.0014	36.1018	32.5057	23.8151	18.3954	15.0292	16.7809	21.8125	28.3323	37.1735	41.9874	46.2522 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-57.6961	-82.4249	-119.9715	-136.5353	-148.4606	-138.8259	-136.9466	-128.6076	-114.2141	-94.8434	-63.7530	-49.7422 (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	-29.3614	-62.1189	-124.1842	-187.6288	-249.2711	-251.0567	-248.2719	-209.8115	-153.1416	-89.3962	-39.3675	-23.2050 (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)

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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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													11920.3591	(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													3387.4304	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													86.0000	(231)
Electricity for lighting (calculated in Appendix L)													363.1874	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2938.8359	(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													12818.1410	(238)

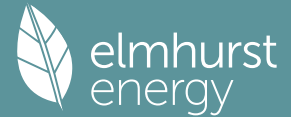
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	11920.3591	0.2100	2503.2754 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3387.4304	0.2100	711.3604 (264)
Space and water heating			3214.6358 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	363.1874	0.1443	52.4192 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1272.0211	0.1344	-170.9012
PV Unit electricity exported	-1666.8148	0.1257	-209.5251
Total			-380.4262 (269)
Total CO2, kg/year			2898.5580 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	11920.3591	1.1300	13470.0058 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3387.4304	1.1300	3827.7964 (278)
Space and water heating			17297.8022 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	363.1874	1.5338	557.0689 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1272.0211	1.4965	-1903.6269
PV Unit electricity exported	-1666.8148	0.4614	-769.0834
Total			-2672.7103 (283)
Total Primary energy kWh/year			15312.2616 (286)
Target Primary Energy Rate (TPER)			64.3800 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 1 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	83 B	DER	15.34	TER	12.19
Environmental	83 B	% DER < TER			-25.84
CO ₂ Emissions (t/year)	3.44	DFEE	49.72	TFEE	50.82
Compliance Check	See BREL	% DFEE < TFEE			2.16
% DPER < TPER	-31.43	DPER	84.61	TPER	64.38
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	237.8300 (1b)	3.0200 (2b)	718.2466 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	237.8300		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 718.2466 (5)

2. Ventilation rate

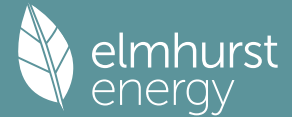
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (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) =	40.0000 / (5) = 0.0557 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.2057 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2057 (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	0.2623	0.2571	0.2520	0.2263	0.2211	0.1954	0.1954	0.1903	0.2057	0.2211	0.2314	0.2417 (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	0.5344	0.5331	0.5317	0.5256	0.5244	0.5191	0.5191	0.5181	0.5212	0.5244	0.5268	0.5292 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			35.4700	1.1450	40.6145		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
Heatloss Floor 1			237.8300	0.1400	33.2962	110.0000	26161.3000 (28a)
EXTERNAL	130.9800	35.4700	95.5100	0.1800	17.1918	70.0000	6685.7000 (29a)
HALLWAY	53.4500	2.9100	50.5400	0.1700	8.5918	70.0000	3537.8000 (29a)
GARAGE WALL	40.8600		40.8600	0.1700	6.9462	70.0000	2860.2000 (29a)

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Flat Roof	69.5800	69.5800	0.1100	7.6538	9.0000	626.2200 (30)
Total net area of external elements Aum(A, m2)		532.7000				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	117.7863			(33)
Party Ceiling 1		168.2500			40.0000	6730.0000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 46601.2200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.6300	0.3000	3.7890
E2 Other lintels (including other steel lintels)	1.1000	0.0400	0.0440
E3 Sill	39.5000	0.0500	1.9750
E4 Jamb	59.4300	0.1600	9.5088
E5 Ground floor (normal)	15.1700	0.0700	1.0619
E22 Basement floor	3.1500	0.0700	0.2205
E7 Party floor between dwellings (in blocks of flats)	39.5900	0.0400	1.5836
E14 Flat roof	24.1600	0.0900	2.1744
E16 Corner (normal)	18.1200	-0.0900	-1.6308
E17 Corner (inverted - internal area greater than external area)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.7264 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 136.5127 (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	126.6617	126.3451	126.0349	124.5777	124.3051	123.0359	123.0359	122.8008	123.5247	124.3051	124.8566	125.4332 (38)
Heat transfer coeff	263.1744	262.8578	262.5476	261.0904	260.8178	259.5486	259.5486	259.3135	260.0374	260.8178	261.3693	261.9459 (39)
Average = Sum(39)m / 12 =												261.0891

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1066	1.1052	1.1039	1.0978	1.0967	1.0913	1.0913	1.0903	1.0934	1.0967	1.0990	1.1014 (40)
HLP (average)												1.0978
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0511 (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 32.5378 32.0545 31.3740 30.1193 29.1798 28.1381 27.5754 28.2511 28.9868 30.1016 31.3821 32.4278 (42b)

Hot water usage for other uses 45.8764 44.2082 42.5399 40.8717 39.2035 37.5352 37.5352 39.2035 40.8717 42.5399 44.2082 45.8764 (42c)

Average daily hot water use (litres/day) 71.8735 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	78.4142	76.2627	73.9140	70.9911	68.3833	65.6733	65.1106	67.4546	69.8586	72.6415	75.5903	78.3042 (44)
Energy conte	124.1889	108.5971	113.6031	97.1832	92.0571	80.7530	78.7456	83.5228	86.1426	98.5738	107.6922	122.6054 (45)
Energy content (annual)												Total = Sum(45)m = 1193.6649

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 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 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 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 0.0000 (61)

Total heat required for water heating calculated for each month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.5606	92.3075	96.5626	82.6057	78.2485	68.6401	66.9338	70.9944	73.2212	83.7878	91.5384	104.2146 (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 105.5606 92.3075 96.5626 82.6057 78.2485 68.6401 66.9338 70.9944 73.2212 83.7878 91.5384 104.2146 (64)
 Total per year (kWh/year) = Sum(64)m = 1015 (64)

12Total per year (kWh/year)
 Electric shower(s) 60.3644 53.7852 58.7313 56.0466 57.0983 54.4662 56.2818 57.0983 56.0466 58.7313 57.6269 60.3644 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 686.6412 (64a)

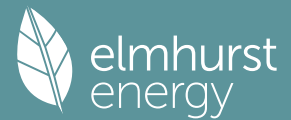
Heat gains from water heating, kWh/month 41.4812 36.5232 38.8235 34.6631 33.8367 30.7766 30.8039 32.0232 32.3169 35.6298 37.2913 41.1447 (65)

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	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	216.5819	239.7871	216.5819	223.8013	216.5819	223.8013	216.5819	216.5819	223.8013	216.5819	223.8013	216.5819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.7149	409.9249	399.3157	376.7300	348.2196	321.4238	303.5226	299.3126	309.9218	332.5075	361.0179	387.8137 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555 (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)												

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Water heating gains (Table 5)	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	(71)
	55.7543	54.3500	52.1821	48.1432	45.4794	42.7452	41.4031	43.0419	44.8846	47.8895	51.7935	55.3021	(72)
Total internal gains	746.8177	772.8286	736.8463	717.4411	679.0476	656.7370	630.2742	627.7030	647.3743	665.7455	705.3793	728.4642	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	35.4700	10.6334	0.6300		0.7000		0.7700	115.2670 (74)

Solar gains	115.2670	220.2811	374.3114	601.2400	809.9254	867.0491	809.5011	642.2359	450.0436	262.2158	142.1966	96.0922	(83)
Total gains	862.0847	993.1097	1111.1577	1318.6811	1488.9729	1523.7861	1439.7754	1269.9389	1097.4179	927.9613	847.5759	824.5565	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	49.1871	49.2463	49.3045	49.5797	49.6315	49.8742	49.8742	49.9194	49.7805	49.6315	49.5268	49.4178	
alpha	4.2791	4.2831	4.2870	4.3053	4.3088	4.3249	4.3249	4.3280	4.3187	4.3088	4.3018	4.2945	
util living area	0.9992	0.9985	0.9964	0.9863	0.9490	0.8455	0.7082	0.7860	0.9499	0.9935	0.9985	0.9994	(86)
MIT	19.0604	19.2208	19.5172	19.9779	20.4430	20.7947	20.9326	20.8928	20.5861	20.0150	19.4678	19.0345	(87)
Th 2	19.9955	19.9966	19.9976	20.0026	20.0036	20.0079	20.0079	20.0087	20.0062	20.0036	20.0017	19.9997	(88)
util rest of house	0.9990	0.9980	0.9952	0.9814	0.9280	0.7774	0.5832	0.6725	0.9197	0.9905	0.9980	0.9992	(89)
MIT 2	18.2009	18.3619	18.6587	19.1201	19.5723	19.8873	19.9832	19.9637	19.7164	19.1600	18.6127	18.1781	(90)
Living area fraction									fLA = Living area / (4) =			0.1917	(91)
MIT	18.3657	18.5266	18.8233	19.2845	19.7392	20.0612	20.1652	20.1418	19.8831	19.3239	18.7766	18.3423	(92)
Temperature adjustment												0.0000	(93)
adjusted MIT	18.3657	18.5266	18.8233	19.2845	19.7392	20.0612	20.1652	20.1418	19.8831	19.3239	18.7766	18.3423	(93)

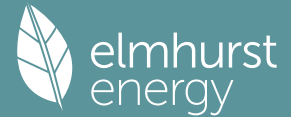
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9970	0.9933	0.9764	0.9208	0.7817	0.6052	0.6902	0.9147	0.9875	0.9971	0.9988	(94)
Useful gains	860.7889	990.1563	1103.6630	1287.5884	1371.0653	1191.1625	871.3571	876.5110	1003.8258	916.3371	845.0992	823.5453	(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	3701.7238	3581.8540	3235.4406	2711.3003	2096.7605	1417.4588	925.3503	970.2992	1503.8223	2275.3459	3051.9107	3704.5187	(97)
Space heating kWh	2113.6556	1741.6208	1586.0426	1025.0726	539.9173	0.0000	0.0000	0.0000	0.0000	1011.1026	1588.9043	2143.4442	(98a)
Space heating requirement - total per year (kWh/year)												11749.7599	
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	2113.6556	1741.6208	1586.0426	1025.0726	539.9173	0.0000	0.0000	0.0000	0.0000	1011.1026	1588.9043	2143.4442	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11749.7599	
Space heating per m2										(98c) / (4) =		49.4040	(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	2439.7566	1920.6595	1970.7829	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6368	0.7252	0.6490	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1553.6888	1392.7768	1279.0435	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1672.2464	1578.4482	1384.4381	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	85.3614	138.1396	78.4136	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	21.3404	34.5349	19.6034	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												75.4787	(107)
Energy for space heating												49.4040	(99)
Energy for space cooling												0.3174	(108)
Total												49.7214	(109)
Fabric Energy Efficiency (DFEE)												49.7	(109)

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)	x	Storey height (m)	=	Volume (m ³)
Ground floor	237.8300 (1b)		3.0200 (2b)		718.2466 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	237.8300				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 718.2466 (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													4 * 10 = 40.0000 (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) =													40.0000 / (5) = 0.0557 (8)
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													5.0000 (17)
Infiltration rate													0.3057 (18)
Number of sides sheltered													0 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.3057 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.3898	0.3821	0.3745	0.3363	0.3286	0.2904	0.2904	0.2828	0.3057	0.3286	0.3439	0.3592	(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	0.5760	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			35.4700	1.1450	40.6145		(27)
Heatloss Floor 1			237.8300	0.1300	30.9179		(28a)
EXTERNAL	130.9800	35.4700	95.5100	0.1800	17.1918		(29a)
HALLWAY	53.4500	2.9100	50.5400	0.1800	9.0972		(29a)
GARAGE WALL	40.8600		40.8600	0.1800	7.3548		(29a)
Flat Roof	69.5800		69.5800	0.1100	7.6538		(30)
Total net area of external elements Aum(A, m ²)			532.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 115.7400		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.9434 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				12.6300	0.0500		0.6315
E3 Sill				1.1000	0.0500		0.0550
E4 Jamb				39.5000	0.0500		1.9750
E5 Ground floor (normal)				59.4300	0.1600		9.5088
E22 Basement floor				15.1700	0.0700		1.0619
E7 Party floor between dwellings (in blocks of flats)				3.1500	0.0700		0.2205
E14 Flat roof				39.5900	0.0800		3.1672
E16 Corner (normal)				24.1600	0.0900		2.1744
E17 Corner (inverted - internal area greater than external area)				18.1200	-0.0900		-1.6308
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1635 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 132.9035 (37)

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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	136.5136	135.8146	135.1293	131.9108	131.3086	128.5054	128.5054	127.9863	129.5852	131.3086	132.5268	133.8004	(38)
Heat transfer coeff	269.4171	268.7181	268.0328	264.8143	264.2121	261.4089	261.4089	260.8898	262.4887	264.2121	265.4303	266.7039	(39)
Average = Sum(39)m / 12 =													264.8114

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1328	1.1299	1.1270	1.1135	1.1109	1.0991	1.0991	1.0970	1.1037	1.1109	1.1161	1.1214	(40)
HLP (average)													1.1134
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy													3.0511 (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	32.5378	32.0545	31.3740	30.1193	29.1798	28.1381	27.5754	28.2511	28.9868	30.1016	31.3821	32.4278	(42b)
Hot water usage for other uses	45.8764	44.2082	42.5399	40.8717	39.2035	37.5352	37.5352	39.2035	40.8717	42.5399	44.2082	45.8764	(42c)
Average daily hot water use (litres/day)													71.8735 (43)
Daily hot water use	78.4142	76.2627	73.9140	70.9911	68.3833	65.6733	65.1106	67.4546	69.8586	72.6415	75.5903	78.3042	(44)
Energy conte	124.1889	108.5971	113.6031	97.1832	92.0571	80.7530	78.7456	83.5228	86.1426	98.5738	107.6922	122.6054	(45)
Energy content (annual)													Total = Sum(45)m = 1193.6649
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	105.5606	92.3075	96.5626	82.6057	78.2485	68.6401	66.9338	70.9944	73.2212	83.7878	91.5384	104.2146	(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	105.5606	92.3075	96.5626	82.6057	78.2485	68.6401	66.9338	70.9944	73.2212	83.7878	91.5384	104.2146	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 1014.6151 (64)
Electric shower(s)	60.3644	53.7852	58.7313	56.0466	57.0983	54.4662	56.2818	57.0983	56.0466	58.7313	57.6269	60.3644	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													686.6412 (64a)
Heat gains from water heating, kWh/month	41.4812	36.5232	38.8235	34.6631	33.8367	30.7766	30.8039	32.0232	32.3169	35.6298	37.2913	41.1447	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	216.5819	239.7871	216.5819	223.8013	216.5819	223.8013	216.5819	216.5819	223.8013	216.5819	223.8013	216.5819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.7149	409.9249	399.3157	376.7300	348.2196	321.4238	303.5226	299.3126	309.9218	332.5075	361.0179	387.8137	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	(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)	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	(71)
Water heating gains (Table 5)	55.7543	54.3500	52.1821	48.1432	45.4794	42.7452	41.4031	43.0419	44.8846	47.8895	51.7935	55.3021	(72)
Total internal gains	746.8177	772.8286	736.8463	717.4411	679.0476	656.7370	630.2742	627.7030	647.3743	665.7455	705.3793	728.4642	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
North	35.4700	10.6334	0.6300	0.7000	0.7700	115.2670 (74)						
Solar gains	115.2670	220.2811	374.3114	601.2400	809.9254	867.0491	809.5011	642.2359	450.0436	262.2158	142.1966	96.0922 (83)
Total gains	862.0847	993.1097	1111.1577	1318.6811	1488.9729	1523.7861	1439.7754	1269.9389	1097.4179	927.9613	847.5759	824.5565 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.0474	48.1724	48.2955	48.8825	48.9939	49.5193	49.5193	49.6178	49.3156	48.9939	48.7690	48.5362
alpha	4.2032	4.2115	4.2197	4.2588	4.2663	4.3013	4.3013	4.3079	4.2877	4.2663	4.2513	4.2357
util living area	0.9992	0.9984	0.9964	0.9865	0.9499	0.8472	0.7110	0.7880	0.9505	0.9935	0.9985	0.9994 (86)
MIT	19.0147	19.1789	19.4813	19.9568	20.4282	20.7900	20.9304	20.8903	20.5781	19.9988	19.4427	18.9995 (87)
Th 2	19.9741	19.9765	19.9788	19.9899	19.9919	20.0015	20.0015	20.0033	19.9978	19.9919	19.9877	19.9834 (88)
util rest of house	0.9990	0.9980	0.9952	0.9815	0.9290	0.7792	0.5854	0.6742	0.9205	0.9905	0.9980	0.9992 (89)
MIT 2	18.1396	18.3054	18.6090	19.0897	19.5491	19.8780	19.9760	19.9572	19.7024	19.1352	18.5773	18.1311 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.3074	18.4728	18.7762	19.2559	19.7176	20.0528	20.1590	20.1361	19.8703	19.3007	18.7432	18.2976 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.3074	18.4728	18.7762	19.2559	19.7176	20.0528	20.1590	20.1361	19.8703	19.3007	18.7432	18.2976 (93)

8. Space heating requirement

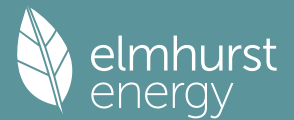
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9984	0.9970	0.9932	0.9765	0.9218	0.7833	0.6074	0.6919	0.9154	0.9875	0.9970	0.9987 (94)
Useful gains	860.7421	990.0891	1103.5920	1287.7424	1372.4671	1193.6535	874.5199	878.6335	1004.5914	916.3234	845.0589	823.5149 (95)
Ext temp.	4.3000	4.9000	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	3773.8221	3647.2689	3290.4281	2742.3949	2118.3524	1425.4214	930.3492	974.7039	1514.6278	2298.8423	3090.4642	3759.8830 (97)
Space heating kWh	2167.3315	1785.6248	1627.0061	1047.3498	554.9386	0.0000	0.0000	0.0000	0.0000	1028.5941	1616.6918	2184.6579 (98a)
Space heating requirement - total per year (kWh/year)	12012.1945											
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	2167.3315	1785.6248	1627.0061	1047.3498	554.9386	0.0000	0.0000	0.0000	0.0000	1028.5941	1616.6918	2184.6579 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	12012.1945											
Space heating per m2	(98c) / (4) = 50.5075 (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	2457.2438	1934.4259	1982.7624	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6328	0.7211	0.6456	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1554.9611	1394.8723	1280.0171	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1672.2464	1578.4482	1384.4381	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	84.4454	136.5805	77.6892	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	21.1113	34.1451	19.4223	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	74.6788 (107)											
Energy for space heating	50.5075 (99)											
Energy for space cooling	0.3140 (108)											
Total	50.8215 (109)											
Fabric Energy Efficiency (TFEE)	50.8 (109)											

Predicted Energy Assessment

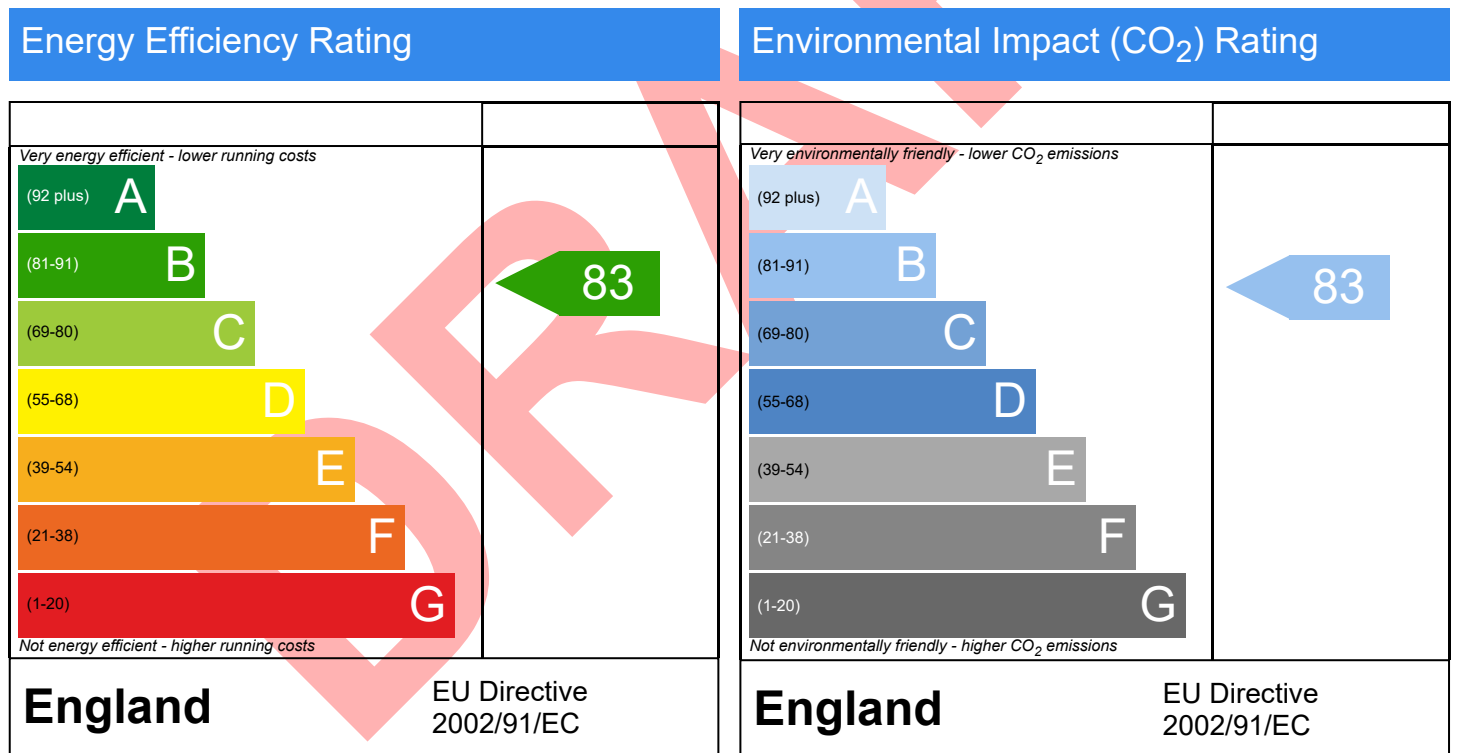


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 237.83 m²
 DRRN:

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.

Overview Report

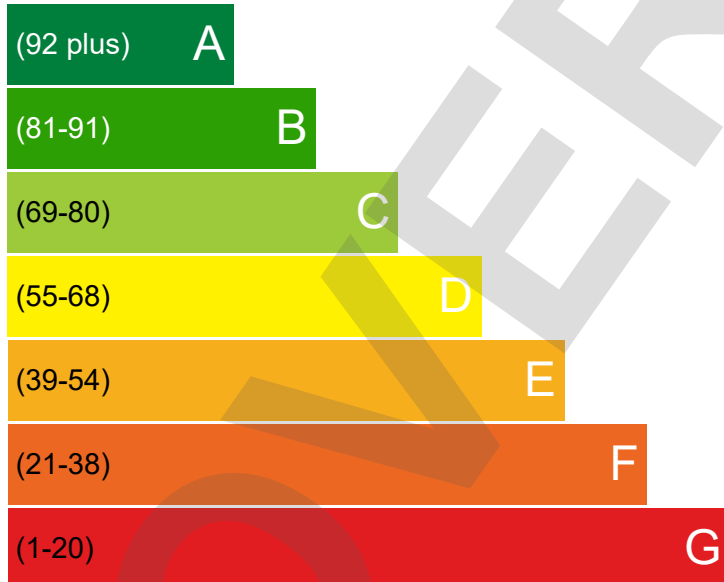
Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Detached
Floor Area [m ²]	238

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



CURRENT

POTENTIAL

83

83

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.14 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 80 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **3.4** per year

With the recommended measures the potential CO emissions could be: **3** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£1002

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:04

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	238 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 1 - Heatpump + PV
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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	12.19 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	1.99 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	64.38 kWh _{PE} /m ²		
Dwelling primary energy	20.28 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	50.8 kWh/m ²		
Dwelling fabric energy efficiency	49.7 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.14	Heatloss Floor 1 (0.14)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	NORTH (1.2)	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)	95.51	0.18
Sheltered wall: Walls (2)	50.54	0.18
Sheltered wall: Walls (3)	40.86	0.18
Ground floor: Heatloss Floor 1, Heatloss Floor 1	237.83	0.14
Exposed roof: Roof (1)	69.58	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
NORTH, Windows	35.47	North	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	South	N/A	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E22: Basement floor	Calculated by person with suitable expertise	0.07	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	

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	3 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	460.7%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	MIDEA
Model	MHC-V16W/D2N8-B
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	500 litres
Declared heat loss	2.1 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

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

Efficiency	
Manufacturer	
Model	

6 Controls

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

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

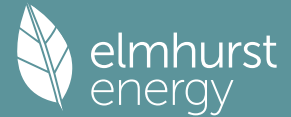
Manufacturer	
Model	

7 Lighting

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	1.79 kWp	
Orientation	South	
Pitch	30°	
Overshading	None or very little	
Manufacturer	PV	
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 1 - Heatpump + PV	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	90 B	DER	1.99	TER	12.19
Environmental	98 A	% DER < TER			83.68
CO ₂ Emissions (t/year)	0.44	DFEE	49.72	TFEE	50.82
Compliance Check	See BREL	% DFEE < TFEE			2.16
% DPER < TPER	68.50	DPER	20.28	TPER	64.38

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	Flat, Detached	
Position of Flat	Basement flat	
Which Floor	0	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	237.83 m ²	3.02 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

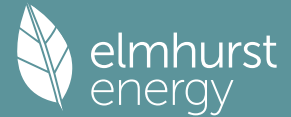
8.0 Living Area	45.59	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	130.98	95.51	0.00	None	35.47	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	53.45	50.54	0.50	Stairwell Access	2.91	Enter Gross Area
	GARAGE WALL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	40.86	40.86	0.30	Garage Double 3 Inside	0.00	Enter Gross Area

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	69.58	0.00	None	0.00	Enter Gross Area	0.00

10.1 Party Ceilings	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	168.25

Summary for Input Data



11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.14	None	0.00	110.00	237.83

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
NORTH	Windows	EXTERNAL	North	35.47	0
ENTRANCE DOOR	Entrance Door	HALLWAY	South	2.91	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	12.63	0.30	0.30	No
E3 Sill	Independently assessed	1.10	0.04	0.04	No
E4 Jamb	Independently assessed	39.50	0.05	0.05	No
E5 Ground floor (normal)	Independently assessed	59.43	0.16	0.16	No
E22 Basement floor	Independently assessed	15.17	0.07	0.07	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	3.15	0.07	0.07	No
E14 Flat roof	Independently assessed	39.59	0.04	0.04	No
E16 Corner (normal)	Independently assessed	24.16	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	18.12	-0.09	-0.09	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested?

Test Method

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Summary for Input Data

Percentage of Heat	100.00	%
Database Ref. No.	105566	
Fuel Type	Electricity	
SAP Code	0	
In Winter	0.00	
In Summer	0.00	
Model Name	MHC-V16W/D2N8-B	
Manufacturer	MIDEA	
System Type	Heat Pump	
Controls SAP Code	2207	
Delayed Start Stat	No	
Burner Control	Modulating	
HETAS approved System	No	
Oil Pump Inside	No	
FI Case	0.00	
Flue Type	None or Unknown	
Fan Assisted Flue	No	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	
Boiler Interlock	No	
Combi boiler type	No Combi	
Combi keep hot type	None	

25.0 Main Heating 2

26.0 Heat Networks

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	No
Summer Immersion	No
Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

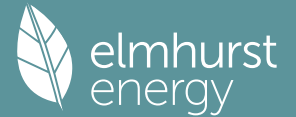
28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		No	

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Summary for Input Data



Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Insulation Thickness Type	80 mm	
Insulation Thickness	80	
Cylinder Volume	500.00	L
Loss	2.10	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store

32.0 Photovoltaic Unit

Export Capable Meter?	No
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
1.79	South	30°	None Or Little	No	No	1.00		PV

34.0 Small-scale Hydro

Electricity Generated	0.00	
Apportioned	0.00	kWh/Year
Connected to dwelling's electricity meter	Yes	
Electricity Generation	Annual	

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

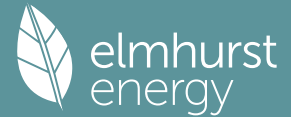
Lower cost measures

None

Further measures to achieve even higher standards

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

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 1 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	90 B	DER	1.99	TER	12.19
Environmental	98 A	% DER < TER			83.68
CO ₂ Emissions (t/year)	0.44	DFEE	49.72	TFEE	50.82
Compliance Check	See BREL	% DFEE < TFEE			2.16
% DPER < TPER	68.50	DPER	20.28	TPER	64.38
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	237.8300 (1b)	3.0200 (2b)	718.2466 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	237.8300		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 718.2466 (5)

2. Ventilation rate

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

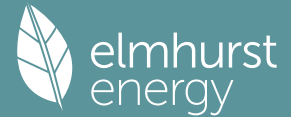
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			35.4700	1.1450	40.6145		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
Heatloss Floor 1			237.8300	0.1400	33.2962	110.0000	26161.3000 (28a)
EXTERNAL	130.9800	35.4700	95.5100	0.1800	17.1918	70.0000	6685.7000 (29a)

Full SAP Calculation Printout



HALLWAY	53.4500	2.9100	50.5400	0.1700	8.5918	70.0000	3537.8000	(29a)
GARAGE WALL	40.8600		40.8600	0.1700	6.9462	70.0000	2860.2000	(29a)
Flat Roof	69.5800		69.5800	0.1100	7.6538	9.0000	626.2200	(30)
Total net area of external elements Aum(A, m2)			532.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	117.7863				(33)
Party Ceiling 1			168.2500			30.0000	5047.5000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 44918.7200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 188.8690 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.6300	0.3000	3.7890
E3 Sill	1.1000	0.0400	0.0440
E4 Jamb	39.5000	0.0500	1.9750
E5 Ground floor (normal)	59.4300	0.1600	9.5088
E22 Basement floor	15.1700	0.0700	1.0619
E7 Party floor between dwellings (in blocks of flats)	3.1500	0.0700	0.2205
E14 Flat roof	39.5900	0.0400	1.5836
E16 Corner (normal)	24.1600	0.0900	2.1744
E17 Corner (inverted - internal area greater than external area)	18.1200	-0.0900	-1.6308

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.7264 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 136.5127 (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	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107	118.5107
Heat transfer coeff	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234	255.0234
Average = Sum(39)m / 12 =												255.0234

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723	1.0723
HLP (average)												1.0723
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

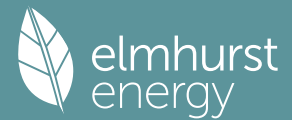
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0511	(42)
Hot water usage for mixer showers	75.3769	74.2442	72.5935	69.4353	67.1045	64.5054	63.0280	64.6662	66.4619	69.2526	72.4787	75.0881	75.0881	(42a)
Hot water usage for baths	34.2503	33.7416	33.0253	31.7046	30.7156	29.6190	29.0267	29.7380	30.5125	31.6859	33.0338	34.1345	34.1345	(42b)
Hot water usage for other uses	48.2910	46.5349	44.7789	43.0229	41.2668	39.5108	39.5108	41.2668	43.0229	44.7789	46.5349	48.2910	48.2910	(42c)
Average daily hot water use (litres/day)													145.1513	(43)
Daily hot water use	157.9182	154.5207	150.3977	144.1627	139.0870	133.6352	131.5655	135.6710	139.9972	145.7174	152.0474	157.5136	157.5136	(44)
Energy conte	250.1038	220.0354	231.1557	197.3515	187.2378	164.3200	159.1170	167.9890	172.6306	197.7371	216.6195	246.6282	246.6282	(45)
Energy content (annual)													2410.9256	
Distribution loss (46)m = 0.15 x (45)m	37.5156	33.0053	34.6734	29.6027	28.0857	24.6480	23.8676	25.1983	25.8946	29.6606	32.4929	36.9942	36.9942	(46)
Water storage loss:													500.0000	(47)
Store volume													2.1000	(48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400	(49)
Temperature factor from Table 2b													1.1340	(55)
Enter (49) or (54) in (55)														
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	(56)
If cylinder contains dedicated solar storage														
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	(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	0.0000	(59)
Total heat required for water heating calculated for each month	308.5202	272.7986	289.5721	253.8835	245.6542	220.8520	217.5334	226.4054	229.1626	256.1535	273.1515	305.0446	305.0446	(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	308.5202	272.7986	289.5721	253.8835	245.6542	220.8520	217.5334	226.4054	229.1626	256.1535	273.1515	305.0446	305.0446	(64)
12Total per year (kWh/year)													3098.7316	(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	129.8926	115.3723	123.5924	110.8450	108.9897	99.8620	99.6395	102.5895	102.6253	112.4807	117.2516	128.7370	128.7370	(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	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	216.5819	239.7871	216.5819	223.8013	216.5819	223.8013	216.5819	216.5819	223.8013	216.5819	223.8013	216.5819

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.7149	409.9249	399.3157	376.7300	348.2196	321.4238	303.5226	299.3126	309.9218	332.5075	361.0179	387.8137	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	(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)	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	(71)
Water heating gains (Table 5)	174.5869	171.6850	166.1188	153.9514	146.4915	138.6972	133.9241	137.8891	142.5351	151.1837	162.8494	173.0336	(72)
Total internal gains	865.6503	890.1637	850.7830	823.2493	780.0596	752.6890	722.7952	722.5501	745.0248	769.0397	816.4352	846.1958	(73)

6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains		
	m2		Table 6a		Specific data		Specific data		factor		W		
			W/m2		or Table 6b		or Table 6c		Table 6d				
North	35.4700		10.6334		0.6300		0.7000		0.7700		115.2670		(74)
Solar gains	115.2670	220.2811	374.3114	601.2400	809.9254	867.0491	809.5011	642.2359	450.0436	262.2158	142.1966	96.0922	(83)
Total gains	980.9172	1110.4447	1225.0944	1424.4893	1589.9850	1619.7381	1532.2964	1364.7860	1195.0683	1031.2556	958.6318	942.2880	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266	48.9266		
alpha	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618	4.2618		
util living area	0.9985	0.9972	0.9939	0.9797	0.9317	0.8130	0.6678	0.7442	0.9291	0.9890	0.9972	0.9988	0.9988	(86)	
Living	19.5287	19.6485	19.8696	20.2065	20.5477	20.7930	20.8853	20.8603	20.6505	20.2312	19.8232	19.5015			
Non living	18.2716	18.4251	18.7081	19.1363	19.5573	19.8305	19.9107	19.8949	19.6867	19.1707	18.6493	18.2367			
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0			
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0			
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10			
MIT	20.2473	19.6485	19.8696	20.2065	20.5477	20.7930	20.8853	20.8603	20.6505	20.2312	19.8232	19.7111	(87)		
Th 2	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	20.0235	(88)		
util rest of house	0.9981	0.9965	0.9921	0.9728	0.9063	0.7412	0.5463	0.6295	0.8914	0.9843	0.9963	0.9984	(89)		
MIT 2	19.3251	18.4251	18.7081	19.1363	19.5573	19.8305	19.9107	19.8949	19.6867	19.1707	18.6493	18.5587	(90)		
Living area fraction	fLA = Living area / (4) =										0.1917	(91)			
MIT	19.5019	18.6597	18.9308	19.3415	19.7472	20.0150	20.0976	20.0800	19.8715	19.3740	18.8744	18.7796	(92)		
Temperature adjustment	0.0000														
adjusted MIT	19.5019	18.6597	18.9308	19.3415	19.7472	20.0150	20.0976	20.0800	19.8715	19.3740	18.8744	18.7796	(93)		

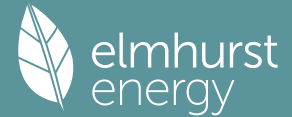
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9949	0.9893	0.9664	0.8973	0.7404	0.5564	0.6370	0.8838	0.9798	0.9947	0.9978	(94)
Useful gains	978.8200	1104.7990	1211.9352	1376.6522	1426.6349	1199.3018	852.5286	869.4320	1056.1600	1010.4212	953.5917	940.2606	(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	3876.8386	3509.0330	3170.1322	2662.8210	2052.2203	1380.9538	891.9618	938.4780	1471.8587	2237.5748	3002.7409	3718.1442	(97)
Space heating kWh	2156.1258	1615.6453	1456.8986	926.0416	465.4355	0.0000	0.0000	0.0000	0.0000	913.0023	1475.3874	2066.7454	(98a)
Space heating requirement - total per year (kWh/year)	11075.2818												
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	2156.1258	1615.6453	1456.8986	926.0416	465.4355	0.0000	0.0000	0.0000	0.0000	913.0023	1475.3874	2066.7454	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	11075.2818												
Space heating per m2											(98c) / (4) =	46.5681	(99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)	0.0000												(201)
Fraction of space heat from main system(s)	1.0000												(202)
Efficiency of main space heating system 1 (in %)	460.7348												(206)
Efficiency of main space heating system 2 (in %)	0.0000												(207)
Efficiency of secondary/supplementary heating system, %	0.0000												(208)
Space heating requirement	2156.1258	1615.6453	1456.8986	926.0416	465.4355	0.0000	0.0000	0.0000	0.0000	913.0023	1475.3874	2066.7454	(98)
Space heating efficiency (main heating system 1)	460.7348	460.7348	460.7348	460.7348	460.7348	0.0000	0.0000	0.0000	0.0000	460.7348	460.7348	460.7348	(210)

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Space heating fuel (main heating system)	467.9755	350.6671	316.2120	200.9923	101.0203	0.0000	0.0000	0.0000	0.0000	198.1622	320.2249	448.5760 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	308.5202	272.7986	289.5721	253.8835	245.6542	220.8520	217.5334	226.4054	229.1626	256.1535	273.1515	305.0446 (64)
Efficiency of water heater	298.5111	298.5111	298.5111	298.5111	298.5111	298.5111	298.5111	298.5111	298.5111	298.5111	298.5111	298.5111 (216)
Fuel for water heating, kWh/month	103.3530	91.3864	97.0055	85.0499	82.2932	73.9845	72.8728	75.8449	76.7685	85.8104	91.5046	102.1887 (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	18.7544	16.9394	18.7544	18.1494	18.7544	18.1494	18.7544	18.7544	18.1494	18.7544	18.1494	18.7544 (231)
Lighting	41.8741	33.5930	30.2467	22.1600	17.1171	13.9848	15.6148	20.2966	26.3633	34.5901	39.0695	43.0379 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-36.6997	-56.2658	-87.7302	-105.4055	-116.9595	-105.4554	-104.0292	-95.2809	-80.6597	-66.4041	-41.5973	-31.1439 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2403.8303 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												298.5111 (217)
Water heating fuel used												1038.0624 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)												
mechanical ventilation fans (SFP = 0.2520)												220.8177 (230a)
Total electricity for the above, kWh/year												220.8177 (231)
Electricity for lighting (calculated in Appendix L)												337.9479 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-927.6312 (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												3073.0271 (238)

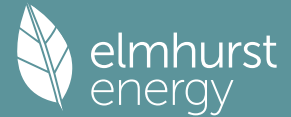
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2403.8303	0.1544	371.2657 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1038.0624	0.1409	146.3066 (264)
Space and water heating			517.5723 (265)
Pumps, fans and electric keep-hot	220.8177	0.1387	30.6301 (267)
Energy for lighting	337.9479	0.1443	48.7763 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-927.6312	0.1337	-124.0214
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-124.0214 (269)
Total CO2, kg/year			472.9574 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.9900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2403.8303	1.5718	3778.3275 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1038.0624	1.5212	1579.0534 (278)
Space and water heating			5357.3809 (279)
Pumps, fans and electric keep-hot	220.8177	1.5128	334.0531 (281)
Energy for lighting	337.9479	1.5338	518.3558 (282)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-927.6312	1.4941	-1385.9599
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1385.9599 (283)
Total Primary energy kWh/year			4823.8298 (286)
Dwelling Primary energy Rate (DPER)			20.2800 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	237.8300 (1b)	x 3.0200 (2b)	= 718.2466 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	237.8300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 718.2466 (5)
Dwelling volume			

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (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 40.0000 / (5) = 0.0557 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3057 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3057 (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	0.3898	0.3821	0.3745	0.3363	0.3286	0.2904	0.2904	0.2828	0.3057	0.3286	0.3439	0.3592 (22b)
Effective ac	0.5760	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645 (25)

3. Heat losses and heat loss parameter

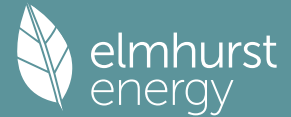
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			35.4700	1.1450	40.6145		(27)
Heatloss Floor 1			237.8300	0.1300	30.9179		(28a)
EXTERNAL	130.9800	35.4700	95.5100	0.1800	17.1918		(29a)
HALLWAY	53.4500	2.9100	50.5400	0.1800	9.0972		(29a)
GARAGE WALL	40.8600		40.8600	0.1800	7.3548		(29a)
Flat Roof	69.5800		69.5800	0.1100	7.6538		(30)
Total net area of external elements Aum(A, m2)			532.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 115.7400		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.6300	0.0500	0.6315
E3 Sill	1.1000	0.0500	0.0550
E4 Jamb	39.5000	0.0500	1.9750
E5 Ground floor (normal)	59.4300	0.1600	9.5088
E22 Basement floor	15.1700	0.0700	1.0619
E7 Party floor between dwellings (in blocks of flats)	3.1500	0.0700	0.2205
E14 Flat roof	39.5900	0.0800	3.1672

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E16 Corner (normal)	24.1600	0.0900	2.1744	
E17 Corner (inverted - internal area greater than external area)	18.1200	-0.0900	-1.6308	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				17.1635 (36)
Point Thermal bridges				0.0000 (36a) =
Total fabric heat loss				132.9035 (37) (33) + (36) + (36a) =

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	136.5136	135.8146	135.1293	131.9108	131.3086	128.5054	128.5054	127.9863	129.5852	131.3086	132.5268	133.8004 (38)
Heat transfer coeff	269.4171	268.7181	268.0328	264.8143	264.2121	261.4089	261.4089	260.8898	262.4887	264.2121	265.4303	266.7039 (39)
Average = Sum(39)m / 12 =												264.8114
HLP	1.1328	1.1299	1.1270	1.1135	1.1109	1.0991	1.0991	1.0970	1.1037	1.1109	1.1161	1.1214 (40)
HLP (average)												1.1134
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

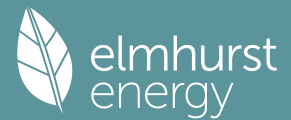
Assumed occupancy													3.0511 (42)
Hot water usage for mixer showers	75.3769	74.2442	72.5935	69.4353	67.1045	64.5054	63.0280	64.6662	66.4619	69.2526	72.4787	75.0881 (42a)	
Hot water usage for baths	32.5378	32.0545	31.3740	30.1193	29.1798	28.1381	27.5754	28.2511	28.9868	30.1016	31.3821	32.4278 (42b)	
Hot water usage for other uses	45.8764	44.2082	42.5399	40.8717	39.2035	37.5352	37.5352	39.2035	40.8717	42.5399	44.2082	45.8764 (42c)	
Average daily hot water use (litres/day)													141.3685 (43)
Daily hot water use	153.7911	150.5069	146.5075	140.4263	135.4879	130.1787	128.1386	132.1207	136.3204	141.8941	148.0690	153.3923 (44)	
Energy conte	243.5675	214.3198	225.1766	192.2366	182.3927	160.0699	154.9725	163.5931	168.0967	192.5490	210.9514	240.1753 (45)	
Energy content (annual)													Total = Sum(45)m = 2348.1012
Distribution loss (46)m = 0.15 x (45)m	36.5351	32.1480	33.7765	28.8355	27.3589	24.0105	23.2459	24.5390	25.2145	28.8824	31.6427	36.0263 (46)	
Water storage loss:													500.0000 (47)
Store volume													2.9009 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.5665 (55)
Enter (49) or (54) in (55)													
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (56)	
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (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	315.3907	279.1923	296.9997	261.7428	254.2158	229.5761	226.7956	235.4162	237.6030	264.3721	280.4577	311.9984 (62)	
MWHR	-34.4592	-30.4760	-31.9127	-26.4250	-24.6271	-21.0736	-19.7532	-21.0055	-21.8036	-25.7040	-29.1195	-33.8211 (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)	
FGHR	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	280.9315	248.7163	265.0870	235.3179	229.5887	208.5025	207.0425	214.4107	215.7994	238.6681	251.3382	278.1774 (64)	
													Total per year (kWh/year) = Sum(64)m = 2873.5800 (64)
12Total per year (kWh/year)													2874 (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	138.4447	123.1593	132.3297	119.5237	118.1041	108.8282	108.9869	111.8532	111.4972	121.4810	125.7463	137.3168 (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	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	216.5819	239.7871	216.5819	223.8013	216.5819	223.8013	216.5819	216.5819	223.8013	216.5819	223.8013	216.5819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.7149	409.9249	399.3157	376.7300	348.2196	321.4238	303.5226	299.3126	309.9218	332.5075	361.0179	387.8137 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555 (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)	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444 (71)
Water heating gains (Table 5)	186.0816	183.2728	177.8625	166.0051	158.7420	151.1503	146.4877	150.3403	154.8572	163.2810	174.6477	184.5656 (72)
Total internal gains	880.1450	904.7514	865.5267	838.3030	795.3101	765.1421	735.3588	735.0014	757.3468	784.1370	831.2335	860.7277 (73)

6. Solar gains

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[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
North				35.4700	10.6334	0.6300	0.7000	0.7700				115.2670 (74)
Solar gains	115.2670	220.2811	374.3114	601.2400	809.9254	867.0491	809.5011	642.2359	450.0436	262.2158	142.1966	96.0922 (83)
Total gains	995.4119	1125.0325	1239.8381	1439.5430	1605.2355	1632.1912	1544.8600	1377.2373	1207.3904	1046.3528	973.4301	956.8200 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.0474	48.1724	48.2955	48.8825	48.9939	49.5193	49.5193	49.6178	49.3156	48.9939	48.7690	48.5362
alpha	4.2032	4.2115	4.2197	4.2588	4.2663	4.3013	4.3013	4.3079	4.2877	4.2663	4.2513	4.2357
util living area	0.9986	0.9975	0.9945	0.9815	0.9369	0.8213	0.6769	0.7519	0.9336	0.9899	0.9974	0.9989 (86)
MIT	19.0871	19.2503	19.5501	20.0182	20.4773	20.8171	20.9426	20.9095	20.6244	20.0612	19.5109	19.0715 (87)
Th 2	19.9741	19.9765	19.9788	19.9899	19.9919	20.0015	20.0015	20.0033	19.9978	19.9919	19.9877	19.9834 (88)
util rest of house	0.9982	0.9967	0.9928	0.9749	0.9120	0.7484	0.5516	0.6344	0.8963	0.9853	0.9966	0.9985 (89)
MIT 2	17.7128	17.9234	18.3088	18.9115	19.4804	19.8671	19.9754	19.9565	19.6695	18.9713	18.2652	17.6989 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.9763	18.1778	18.5467	19.1237	19.6715	20.0493	20.1608	20.1392	19.8525	19.1802	18.5040	17.9621 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.9763	18.1778	18.5467	19.1237	19.6715	20.0493	20.1608	20.1392	19.8525	19.1802	18.5040	17.9621 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9970	0.9947	0.9891	0.9670	0.9019	0.7524	0.5735	0.6526	0.8892	0.9798	0.9945	0.9975 (94)
Ext temp.	992.4424	1119.0528	1226.2920	1392.0752	1447.7112	1228.1033	885.9005	898.8078	1073.6519	1025.1793	968.1053	954.4384 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	3684.6214	3567.9759	3228.9129	2707.3795	2106.1727	1424.4835	930.8224	975.5146	1509.9732	2266.9943	3026.9763	3670.3954 (97)
Space heating requirement - total per year (kWh/year)	2002.9811	1645.6763	1489.9500	947.0191	489.8954	0.0000	0.0000	0.0000	0.0000	923.9104	1482.3872	2020.6720 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating requirement after solar contribution - total per year (kWh/year)	2002.9811	1645.6763	1489.9500	947.0191	489.8954	0.0000	0.0000	0.0000	0.0000	923.9104	1482.3872	2020.6720 (98c)
Space heating per m ²	(98c) / (4) =											46.2620 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2002.9811	1645.6763	1489.9500	947.0191	489.8954	0.0000	0.0000	0.0000	0.0000	923.9104	1482.3872	2020.6720 (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)	2170.0771	1782.9646	1614.2470	1026.0229	530.7642	0.0000	0.0000	0.0000	0.0000	1000.9863	1606.0533	2189.2438 (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	280.9315	248.7163	265.0870	235.3179	229.5887	208.5025	207.0425	214.4107	215.7994	238.6681	251.3382	278.1774 (64)
Efficiency of water heater (217)m	87.5850	87.5043	87.3126	86.8505	85.7152	79.8000	79.8000	79.8000	79.8000	86.7905	87.3715	79.8000 (216)
Fuel for water heating, kWh/month	320.7531	284.2332	303.6067	270.9459	267.8506	261.2813	259.4517	268.6851	270.4253	274.9933	287.6662	317.5380 (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	45.0014	36.1018	32.5057	23.8151	18.3954	15.0292	16.7809	21.8125	28.3323	37.1735	41.9874	46.2522 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-57.6961	-82.4249	-119.9715	-136.5353	-148.4606	-138.8259	-136.9466	-128.6076	-114.2141	-94.8434	-63.7530	-49.7422 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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	-29.3614	-62.1189	-124.1842	-187.6288	-249.2711	-251.0567	-248.2719	-209.8115	-153.1416	-89.3962	-39.3675	-23.2050	(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												11920.3591	(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												3387.4304	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.1874	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2938.8359	(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												12818.1410	(238)

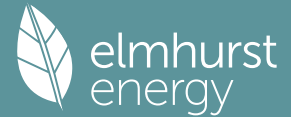
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	11920.3591	0.2100	2503.2754 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3387.4304	0.2100	711.3604 (264)
Space and water heating			3214.6358 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	363.1874	0.1443	52.4192 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1272.0211	0.1344	-170.9012
PV Unit electricity exported	-1666.8148	0.1257	-209.5251
Total			-380.4262 (269)
Total CO2, kg/year			2898.5580 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	11920.3591	1.1300	13470.0058 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3387.4304	1.1300	3827.7964 (278)
Space and water heating			17297.8022 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	363.1874	1.5338	557.0689 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1272.0211	1.4965	-1903.6269
PV Unit electricity exported	-1666.8148	0.4614	-769.0834
Total			-2672.7103 (283)
Total Primary energy kWh/year			15312.2616 (286)
Target Primary Energy Rate (TPER)			64.3800 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 1 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	90 B	DER	1.99	TER	12.19
Environmental	98 A	% DER < TER			83.68
CO ₂ Emissions (t/year)	0.44	DFEE	49.72	TFEE	50.82
Compliance Check	See BREL	% DFEE < TFEE			2.16
% DPER < TPER	68.50	DPER	20.28	TPER	64.38
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	237.8300 (1b)	3.0200 (2b)	718.2466 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	237.8300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 718.2466 (5)
Dwelling volume			

2. Ventilation rate

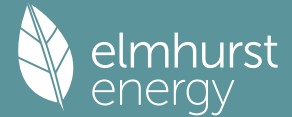
	Yes	Blower Door	Air changes per hour
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5) =	0.0557 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.2057 (18)
Number of sides sheltered			0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2057 (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	0.2623	0.2571	0.2520	0.2263	0.2211	0.1954	0.1954	0.1903	0.2057	0.2211	0.2314	0.2417 (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	0.5344	0.5331	0.5317	0.5256	0.5244	0.5191	0.5191	0.5181	0.5212	0.5244	0.5268	0.5292 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			35.4700	1.1450	40.6145		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
Heatloss Floor 1			237.8300	0.1400	33.2962	110.0000	26161.3000 (28a)
EXTERNAL	130.9800	35.4700	95.5100	0.1800	17.1918	70.0000	6685.7000 (29a)
HALLWAY	53.4500	2.9100	50.5400	0.1700	8.5918	70.0000	3537.8000 (29a)
GARAGE WALL	40.8600		40.8600	0.1700	6.9462	70.0000	2860.2000 (29a)

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Flat Roof	69.5800	69.5800	0.1100	7.6538	9.0000	626.2200 (30)
Total net area of external elements Aum(A, m2)		532.7000				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	117.7863			(33)
Party Ceiling 1		168.2500			40.0000	6730.0000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 46601.2200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 195.9434 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.6300	0.3000	3.7890
E2 Other lintels (including other steel lintels)	1.1000	0.0400	0.0440
E3 Sill	39.5000	0.0500	1.9750
E4 Jamb	59.4300	0.1600	9.5088
E5 Ground floor (normal)	15.1700	0.0700	1.0619
E22 Basement floor	3.1500	0.0700	0.2205
E7 Party floor between dwellings (in blocks of flats)	39.5900	0.0400	1.5836
E14 Flat roof	24.1600	0.0900	2.1744
E16 Corner (normal)	18.1200	-0.0900	-1.6308
E17 Corner (inverted - internal area greater than external area)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.7264 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 136.5127 (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	126.6617	126.3451	126.0349	124.5777	124.3051	123.0359	123.0359	122.8008	123.5247	124.3051	124.8566	125.4332 (38)
Heat transfer coeff	263.1744	262.8578	262.5476	261.0904	260.8178	259.5486	259.5486	259.3135	260.0374	260.8178	261.3693	261.9459 (39)
Average = Sum(39)m / 12 =												261.0891

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1066	1.1052	1.1039	1.0978	1.0967	1.0913	1.0913	1.0903	1.0934	1.0967	1.0990	1.1014 (40)
HLP (average)												1.0978
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0511 (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 32.5378 32.0545 31.3740 30.1193 29.1798 28.1381 27.5754 28.2511 28.9868 30.1016 31.3821 32.4278 (42b)

Hot water usage for other uses 45.8764 44.2082 42.5399 40.8717 39.2035 37.5352 37.5352 39.2035 40.8717 42.5399 44.2082 45.8764 (42c)

Average daily hot water use (litres/day) 71.8735 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	78.4142	76.2627	73.9140	70.9911	68.3833	65.6733	65.1106	67.4546	69.8586	72.6415	75.5903	78.3042 (44)
Energy conte	124.1889	108.5971	113.6031	97.1832	92.0571	80.7530	78.7456	83.5228	86.1426	98.5738	107.6922	122.6054 (45)
Energy content (annual)												Total = Sum(45)m = 1193.6649

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 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 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 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 0.0000 (61)

Total heat required for water heating calculated for each month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.5606	92.3075	96.5626	82.6057	78.2485	68.6401	66.9338	70.9944	73.2212	83.7878	91.5384	104.2146 (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 105.5606 92.3075 96.5626 82.6057 78.2485 68.6401 66.9338 70.9944 73.2212 83.7878 91.5384 104.2146 (64)
 Total per year (kWh/year) = Sum(64)m = 1015 (64)

12Total per year (kWh/year)
 Electric shower(s) 60.3644 53.7852 58.7313 56.0466 57.0983 54.4662 56.2818 57.0983 56.0466 58.7313 57.6269 60.3644 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 686.6412 (64a)

Heat gains from water heating, kWh/month

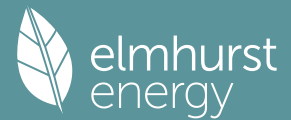
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
41.4812	36.5232	38.8235	34.6631	33.8367	30.7766	30.8039	32.0232	32.3169	35.6298	37.2913	41.1447 (65)	

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	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	216.5819	239.7871	216.5819	223.8013	216.5819	223.8013	216.5819	216.5819	223.8013	216.5819	223.8013	216.5819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.7149	409.9249	399.3157	376.7300	348.2196	321.4238	303.5226	299.3126	309.9218	332.5075	361.0179	387.8137 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555 (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)												

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Water heating gains (Table 5)	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	(71)
	55.7543	54.3500	52.1821	48.1432	45.4794	42.7452	41.4031	43.0419	44.8846	47.8895	51.7935	55.3021	(72)
Total internal gains	746.8177	772.8286	736.8463	717.4411	679.0476	656.7370	630.2742	627.7030	647.3743	665.7455	705.3793	728.4642	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	35.4700	10.6334	0.6300		0.7000		0.7700	115.2670 (74)

Solar gains	115.2670	220.2811	374.3114	601.2400	809.9254	867.0491	809.5011	642.2359	450.0436	262.2158	142.1966	96.0922	(83)
Total gains	862.0847	993.1097	1111.1577	1318.6811	1488.9729	1523.7861	1439.7754	1269.9389	1097.4179	927.9613	847.5759	824.5565	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000
tau	49.1871	49.2463	49.3045	49.5797	49.6315	49.8742	49.8742	49.9194	49.7805	49.6315	49.5268	49.4178	
alpha	4.2791	4.2831	4.2870	4.3053	4.3088	4.3249	4.3249	4.3280	4.3187	4.3088	4.3018	4.2945	
util living area	0.9992	0.9985	0.9964	0.9863	0.9490	0.8455	0.7082	0.7860	0.9499	0.9935	0.9985	0.9994	(86)
MIT	19.0604	19.2208	19.5172	19.9779	20.4430	20.7947	20.9326	20.8928	20.5861	20.0150	19.4678	19.0345	(87)
Th 2	19.9955	19.9966	19.9976	20.0026	20.0036	20.0079	20.0079	20.0087	20.0062	20.0036	20.0017	19.9997	(88)
util rest of house	0.9990	0.9980	0.9952	0.9814	0.9280	0.7774	0.5832	0.6725	0.9197	0.9905	0.9980	0.9992	(89)
MIT 2	18.2009	18.3619	18.6587	19.1201	19.5723	19.8873	19.9832	19.9637	19.7164	19.1600	18.6127	18.1781	(90)
Living area fraction									fLA = Living area / (4) =			0.1917	(91)
MIT	18.3657	18.5266	18.8233	19.2845	19.7392	20.0612	20.1652	20.1418	19.8831	19.3239	18.7766	18.3423	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3657	18.5266	18.8233	19.2845	19.7392	20.0612	20.1652	20.1418	19.8831	19.3239	18.7766	18.3423	(93)

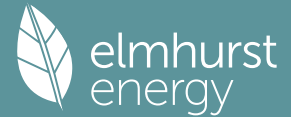
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9970	0.9933	0.9764	0.9208	0.7817	0.6052	0.6902	0.9147	0.9875	0.9971	0.9988	(94)
Useful gains	860.7889	990.1563	1103.6630	1287.5884	1371.0653	1191.1625	871.3571	876.5110	1003.8258	916.3371	845.0992	823.5453	(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	3701.7238	3581.8540	3235.4406	2711.3003	2096.7605	1417.4588	925.3503	970.2992	1503.8223	2275.3459	3051.9107	3704.5187	(97)
Space heating kWh	2113.6556	1741.6208	1586.0426	1025.0726	539.9173	0.0000	0.0000	0.0000	0.0000	1011.1026	1588.9043	2143.4442	(98a)
Space heating requirement - total per year (kWh/year)												11749.7599	
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	2113.6556	1741.6208	1586.0426	1025.0726	539.9173	0.0000	0.0000	0.0000	0.0000	1011.1026	1588.9043	2143.4442	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11749.7599	
Space heating per m2										(98c) / (4) =		49.4040	(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	2439.7566	1920.6595	1970.7829	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6368	0.7252	0.6490	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1553.6888	1392.7768	1279.0435	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1672.2464	1578.4482	1384.4381	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	85.3614	138.1396	78.4136	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	21.3404	34.5349	19.6034	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												75.4787	(107)
Energy for space heating												49.4040	(99)
Energy for space cooling												0.3174	(108)
Total												49.7214	(109)
Fabric Energy Efficiency (DFEE)												49.7	(109)

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

1. Overall dwelling characteristics

	Area (m ²)	x	Storey height (m)	=	Volume (m ³)
Ground floor	237.8300 (1b)		3.0200 (2b)		718.2466 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	237.8300				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 718.2466 (5)

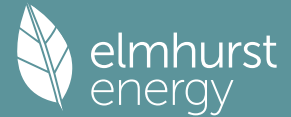
2. Ventilation rate

	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													4 * 10 = 40.0000 (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 40.0000 / (5) = 0.0557 (8)
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													5.0000 (17)
Infiltration rate													0.3057 (18)
Number of sides sheltered													0 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.3057 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.3898	0.3821	0.3745	0.3363	0.3286	0.2904	0.2904	0.2828	0.3057	0.3286	0.3439	0.3592	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23c)
Effective ac	0.5760	0.5730	0.5701	0.5565	0.5540	0.5422	0.5422	0.5400	0.5467	0.5540	0.5591	0.5645	(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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			35.4700	1.1450	40.6145		(27)
Heatloss Floor 1			237.8300	0.1300	30.9179		(28a)
EXTERNAL	130.9800	35.4700	95.5100	0.1800	17.1918		(29a)
HALLWAY	53.4500	2.9100	50.5400	0.1800	9.0972		(29a)
GARAGE WALL	40.8600		40.8600	0.1800	7.3548		(29a)
Flat Roof	69.5800		69.5800	0.1100	7.6538		(30)
Total net area of external elements Aum(A, m ²)			532.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 115.7400		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.9434 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				12.6300	0.0500	0.6315	
E3 Sill				1.1000	0.0500	0.0550	
E4 Jamb				39.5000	0.0500	1.9750	
E5 Ground floor (normal)				59.4300	0.1600	9.5088	
E22 Basement floor				15.1700	0.0700	1.0619	
E7 Party floor between dwellings (in blocks of flats)				3.1500	0.0700	0.2205	
E14 Flat roof				39.5900	0.0800	3.1672	
E16 Corner (normal)				24.1600	0.0900	2.1744	
E17 Corner (inverted - internal area greater than external area)				18.1200	-0.0900	-1.6308	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1635 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 132.9035 (37)

Full SAP Calculation Printout



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	136.5136	135.8146	135.1293	131.9108	131.3086	128.5054	128.5054	127.9863	129.5852	131.3086	132.5268	133.8004	(38)
Heat transfer coeff	269.4171	268.7181	268.0328	264.8143	264.2121	261.4089	261.4089	260.8898	262.4887	264.2121	265.4303	266.7039	(39)
Average = Sum(39)m / 12 =													264.8114

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1328	1.1299	1.1270	1.1135	1.1109	1.0991	1.0991	1.0970	1.1037	1.1109	1.1161	1.1214	(40)
HLP (average)													1.1134
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy													3.0511 (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	32.5378	32.0545	31.3740	30.1193	29.1798	28.1381	27.5754	28.2511	28.9868	30.1016	31.3821	32.4278	(42b)
Hot water usage for other uses	45.8764	44.2082	42.5399	40.8717	39.2035	37.5352	37.5352	39.2035	40.8717	42.5399	44.2082	45.8764	(42c)
Average daily hot water use (litres/day)													71.8735 (43)
Daily hot water use	78.4142	76.2627	73.9140	70.9911	68.3833	65.6733	65.1106	67.4546	69.8586	72.6415	75.5903	78.3042	(44)
Energy conte	124.1889	108.5971	113.6031	97.1832	92.0571	80.7530	78.7456	83.5228	86.1426	98.5738	107.6922	122.6054	(45)
Energy content (annual)													Total = Sum(45)m = 1193.6649
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	105.5606	92.3075	96.5626	82.6057	78.2485	68.6401	66.9338	70.9944	73.2212	83.7878	91.5384	104.2146	(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	105.5606	92.3075	96.5626	82.6057	78.2485	68.6401	66.9338	70.9944	73.2212	83.7878	91.5384	104.2146	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 1014.6151 (64)
Electric shower(s)	60.3644	53.7852	58.7313	56.0466	57.0983	54.4662	56.2818	57.0983	56.0466	58.7313	57.6269	60.3644	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													686.6412 (64a)
Heat gains from water heating, kWh/month	41.4812	36.5232	38.8235	34.6631	33.8367	30.7766	30.8039	32.0232	32.3169	35.6298	37.2913	41.1447	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	152.5554	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	216.5819	239.7871	216.5819	223.8013	216.5819	223.8013	216.5819	216.5819	223.8013	216.5819	223.8013	216.5819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.7149	409.9249	399.3157	376.7300	348.2196	321.4238	303.5226	299.3126	309.9218	332.5075	361.0179	387.8137	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	38.2555	(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)	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	-122.0444	(71)
Water heating gains (Table 5)	55.7543	54.3500	52.1821	48.1432	45.4794	42.7452	41.4031	43.0419	44.8846	47.8895	51.7935	55.3021	(72)
Total internal gains	746.8177	772.8286	736.8463	717.4411	679.0476	656.7370	630.2742	627.7030	647.3743	665.7455	705.3793	728.4642	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
North	35.4700	10.6334	0.6300	0.7000	0.7700	115.2670 (74)						
Solar gains	115.2670	220.2811	374.3114	601.2400	809.9254	867.0491	809.5011	642.2359	450.0436	262.2158	142.1966	96.0922 (83)
Total gains	862.0847	993.1097	1111.1577	1318.6811	1488.9729	1523.7861	1439.7754	1269.9389	1097.4179	927.9613	847.5759	824.5565 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.0474	48.1724	48.2955	48.8825	48.9939	49.5193	49.5193	49.6178	49.3156	48.9939	48.7690	48.5362
alpha	4.2032	4.2115	4.2197	4.2588	4.2663	4.3013	4.3013	4.3079	4.2877	4.2663	4.2513	4.2357
util living area	0.9992	0.9984	0.9964	0.9865	0.9499	0.8472	0.7110	0.7880	0.9505	0.9935	0.9985	0.9994 (86)
MIT	19.0147	19.1789	19.4813	19.9568	20.4282	20.7900	20.9304	20.8903	20.5781	19.9988	19.4427	18.9995 (87)
Th 2	19.9741	19.9765	19.9788	19.9899	19.9919	20.0015	20.0015	20.0033	19.9978	19.9919	19.9877	19.9834 (88)
util rest of house	0.9990	0.9980	0.9952	0.9815	0.9290	0.7792	0.5854	0.6742	0.9205	0.9905	0.9980	0.9992 (89)
MIT 2	18.1396	18.3054	18.6090	19.0897	19.5491	19.8780	19.9760	19.9572	19.7024	19.1352	18.5773	18.1311 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.3074	18.4728	18.7762	19.2559	19.7176	20.0528	20.1590	20.1361	19.8703	19.3007	18.7432	18.2976 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3074	18.4728	18.7762	19.2559	19.7176	20.0528	20.1590	20.1361	19.8703	19.3007	18.7432	18.2976 (93)

8. Space heating requirement

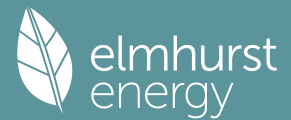
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9984	0.9970	0.9932	0.9765	0.9218	0.7833	0.6074	0.6919	0.9154	0.9875	0.9970	0.9987 (94)
Useful gains	860.7421	990.0891	1103.5920	1287.7424	1372.4671	1193.6535	874.5199	878.6335	1004.5914	916.3234	845.0589	823.5149 (95)
Ext temp.	4.3000	4.9000	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	3773.8221	3647.2689	3290.4281	2742.3949	2118.3524	1425.4214	930.3492	974.7039	1514.6278	2298.8423	3090.4642	3759.8830 (97)
Space heating kWh	2167.3315	1785.6248	1627.0061	1047.3498	554.9386	0.0000	0.0000	0.0000	0.0000	1028.5941	1616.6918	2184.6579 (98a)
Space heating requirement - total per year (kWh/year)												12012.1945
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	2167.3315	1785.6248	1627.0061	1047.3498	554.9386	0.0000	0.0000	0.0000	0.0000	1028.5941	1616.6918	2184.6579 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12012.1945
Space heating per m2												(98c) / (4) = 50.5075 (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	2457.2438	1934.4259	1982.7624	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6328	0.7211	0.6456	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1554.9611	1394.8723	1280.0171	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1672.2464	1578.4482	1384.4381	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	84.4454	136.5805	77.6892	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	21.1113	34.1451	19.4223	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												74.6788 (107)
Energy for space heating												50.5075 (99)
Energy for space cooling												0.3140 (108)
Total												50.8215 (109)
Fabric Energy Efficiency (TFEE)												50.8 (109)

Predicted Energy Assessment

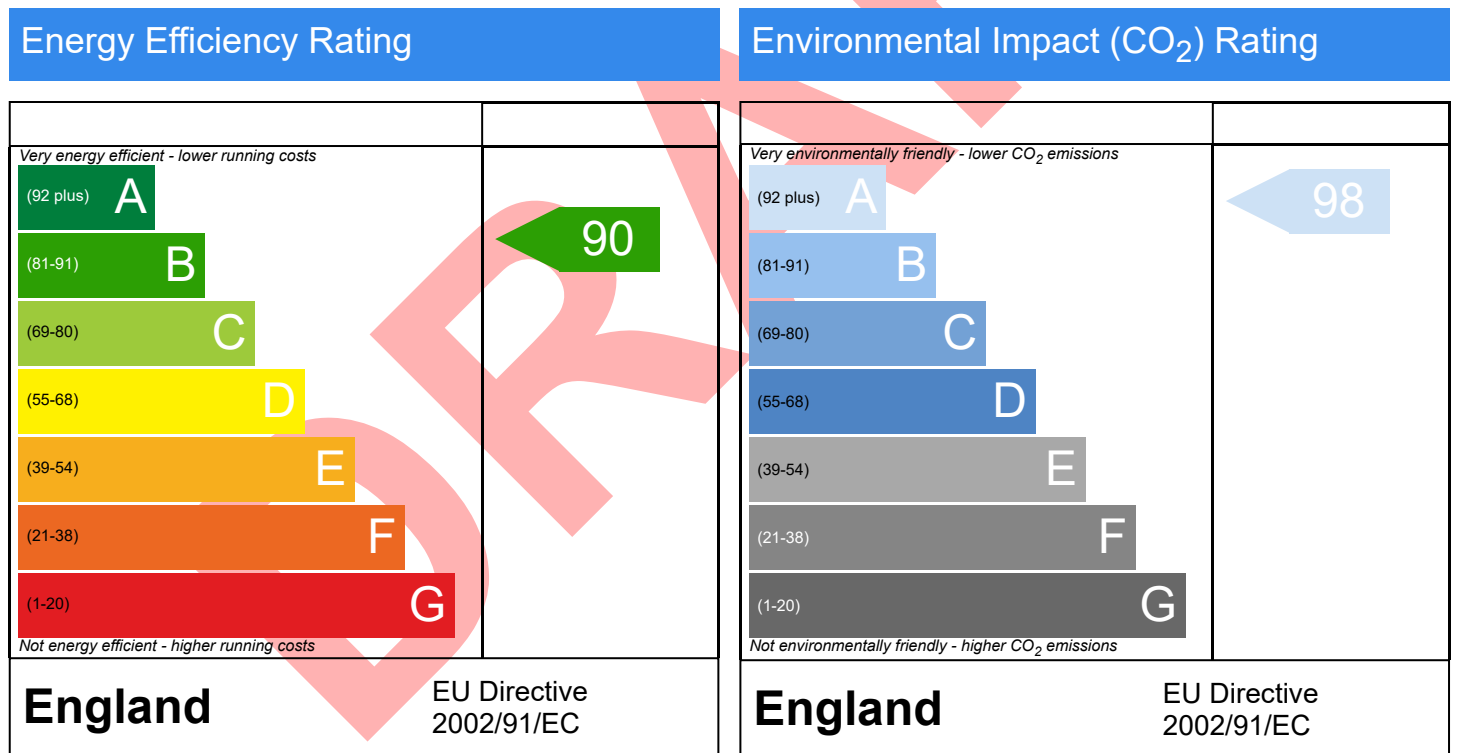


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 237.83 m²
 DRRN:

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.

Overview Report

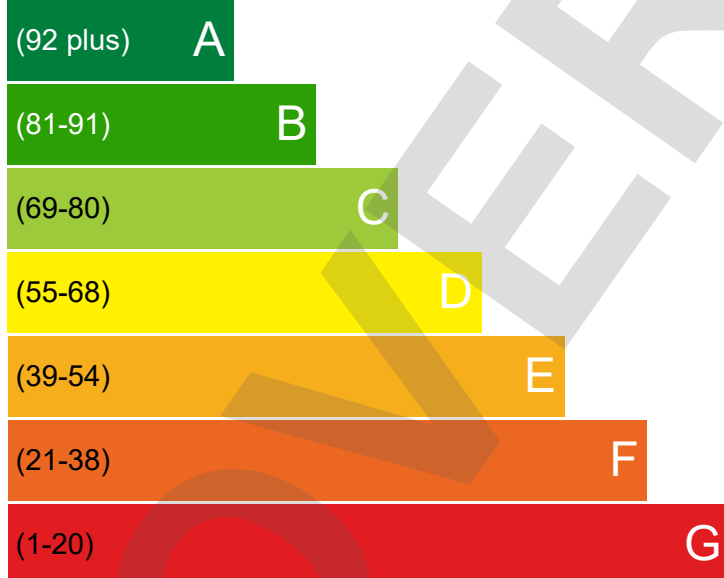
Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Detached
Floor Area [m ²]	238

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



CURRENT

POTENTIAL

90

90

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.14 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 19 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.4** per year

With the recommended measures the potential CO emissions could be: **0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£613

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:04

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Semi-detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	216 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 2 - Boiler
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	9.96 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	12.9 kgCO ₂ /m ²	FAIL
1b Target primary energy rate and dwelling primary energy		
Target primary energy	52.38 kWh _{PE} /m ²	
Dwelling primary energy	71.55 kWh _{PE} /m ²	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	39.4 kWh/m ²	
Dwelling fabric energy efficiency	38.4 kWh/m ²	OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.14	Heatloss Floor 1 (0.14)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	WEST (1.2)	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)	83.98	0.18
Sheltered wall: Walls (2)	29.26	0.18
Party wall: Party Wall (1)	37.19	0 (!)
Upper floor: Heatloss Floor 1, Heatloss Floor 1	108.37	0.14
Exposed roof: Roof (1)	30.57	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
WEST, Windows	8.86	West	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	East	N/A	1.2
SOUTH, Windows	2.24	South	0.7	1.2
NORTH, Windows	17.5	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.32	
External wall	E21: Exposed floor (inverted)	Calculated by person with suitable expertise	0.32	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

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		3 m ³ /hm ² , Design value (!)		OK
Air permeability test certificate reference				

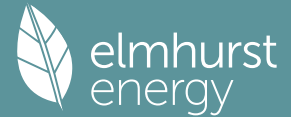
4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	84.2%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Regular boiler
Manufacturer	Vaillant
Model	ecoFIT pure 630
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	500 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 2 - Boiler	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	85 B	DER	12.90	TER	9.96
Environmental	86 B	% DER < TER			-29.52
CO ₂ Emissions (t/year)	2.63	DFEE	38.45	TFEE	39.40
Compliance Check	See BREL	% DFEE < TFEE			2.41
% DPER < TPER	-36.59	DPER	71.55	TPER	52.38

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
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	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	215.74 m ²	2.79 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	68.73	m ²
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9.0 External Walls	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
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	112.58	83.98	0.00	None	28.60	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	32.17	29.26	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	37.19	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	30.57	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	185.17

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Exposed Floor - Solid	Lowest occupied	Other	0.14	Garage Double 1 Inside	0.60	0.00	108.37
UNHEATED SPACE BELOW	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.14	Stairwell Access Corridor 1	0.50	110.00	24.56

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	82.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
WEST	Windows	EXTERNAL	West	8.86	0
ENTRANCE DOOR	Entrance Door	HALLWAY	East	2.91	0
SOUTH	Windows	EXTERNAL	South	2.24	0
NORTH	Windows	EXTERNAL	North	17.50	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	16.62	0.30	0.30	No
E3 Sill	Independently assessed	9.39	0.04	0.04	No
E4 Jamb	Independently assessed	37.28	0.05	0.05	No
E20 Exposed floor (normal)	Independently assessed	30.21	0.32	0.32	No
E21 Exposed floor (inverted)	Independently assessed	6.89	0.32	0.32	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	10.14	0.07	0.07	No
E14 Flat roof	Independently assessed	18.88	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.74	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	16.74	-0.09	-0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	28.91	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	2.69	0.12	0.12	No
E18 Party wall between dwellings	Independently assessed	11.16	0.06	0.06	No

Y-value W/m²K

18.0 Pressure Testing

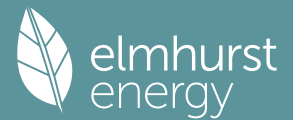
Designed AP₅₀ m³/(h.m²) @ 50 Pa
 Property Tested?
 Test Method
 As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present
 Approved Installation
 Mechanical Ventilation data Type
 Type
 MV Reference Number
 Configuration
 Manufacturer SFP
 Duct Type

Summary for Input Data



MVHR Efficiency	<input type="text" value="0.00"/>
Wet Rooms	<input type="text" value="4"/>
SFP from Installer Commissioning Certificate	<input type="text" value="No"/>

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Database	<input type="text" value="Database"/>
Percentage of Heat	<input type="text" value="100.00"/> %
Database Ref. No.	<input type="text" value="17972"/>
Fuel Type	<input type="text" value="Mains gas"/>
SAP Code	<input type="text" value="0"/>
In Winter	<input type="text" value="89.20"/>
In Summer	<input type="text" value="80.20"/>
Model Name	<input type="text" value="ecoFIT pure 630"/>
Manufacturer	<input type="text" value="Vaillant"/>
System Type	<input type="text" value="Regular boiler"/>
Controls SAP Code	<input type="text" value="2110"/>
Delayed Start Stat	<input type="text" value="No"/>
Burner Control	<input type="text" value="Modulating"/>
HETAS approved System	<input type="text" value="No"/>
Oil Pump Inside	<input type="text" value="No"/>
FI Case	<input type="text" value="0.00"/>
Flue Type	<input type="text" value="Balanced"/>
Fan Assisted Flue	<input type="text" value="Yes"/>
Is MHS Pumped	<input type="text" value="Pump in heated space"/>
Heating Pump Age	<input type="text" value="2013 or later"/>
Heat Emitter	<input type="text" value="Radiators and Underfloor"/>
Underfloor Heating	<input type="text" value="Yes - Pipes in thin screed"/>
Flow Temperature	<input type="text" value="Unknown"/>
Boiler Interlock	<input type="text" value="No"/>
Combi boiler type	<input type="text" value="No Combi"/>
Combi keep hot type	<input type="text" value="None"/>

25.0 Main Heating 2

26.0 Heat Networks

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating	<input type="text" value="Main Heating 1"/>
SAP Code	<input type="text" value="901"/>
Flue Gas Heat Recovery System	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 1	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 2	<input type="text" value="No"/>

Summary for Input Data



Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No
Summer Immersion	No
Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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
Independent Time Control	Yes
Insulation Type	Foam
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

None

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
Solar water heating			0	0
			0	0
			0	0

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 2 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	85 B	DER	12.90	TER	9.96
Environmental	86 B	% DER < TER			-29.52
CO ₂ Emissions (t/year)	2.63	DFEE	38.45	TFEE	39.40
Compliance Check	See BREL	% DFEE < TFEE			2.41
% DPER < TPER	-36.59	DPER	71.55	TPER	52.38
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	215.7400 (1b)	2.7900 (2b)	601.9146 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	215.7400		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 601.9146 (5)

2. Ventilation rate

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

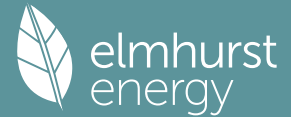
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			28.6000	1.1450	32.7481		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
UNHEATED SPACE BELOW			24.5600	0.1308	3.2135	110.0000	2701.6000 (28a)
Heatloss Floor 1			108.3700	0.1292	13.9961		(28b)

Full SAP Calculation Printout



EXTERNAL	112.5800	28.6000	83.9800	0.1800	15.1164	70.0000	5878.6000 (29a)
HALLWAY	32.1700	2.9100	29.2600	0.1700	4.9742	70.0000	2048.2000 (29a)
Flat Roof	30.5700		30.5700	0.1100	3.3627	9.0000	275.1300 (30)
Total net area of external elements Aum(A, m2)			308.2500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	76.9030			(33)
Party Wall 1			37.1900	0.0000	0.0000	180.0000	6694.2000 (32)
Party Floor 1			82.8100			40.0000	3312.4000 (32d)
Party Ceiling 1			185.1700			30.0000	5555.1000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 26465.2300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 122.6719 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	16.6200	0.3000	4.9860
E3 Sill	9.3900	0.0400	0.3756
E4 Jamb	37.2800	0.0500	1.8640
E20 Exposed floor (normal)	30.2100	0.3200	9.6672
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.1400	0.0700	0.7098
E14 Flat roof	18.8800	0.0400	0.7552
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			21.5550 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 98.4580 (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	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159 (38)
Average = Sum(39)m / 12 =	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739 (39)

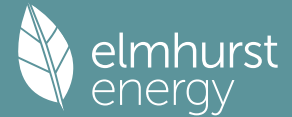
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0224 (42)

Hot water usage for mixer showers	74.8954	73.7699	72.1298	68.9917	66.6759	64.0933	62.6253	64.2531	66.0373	68.8102	72.0157	74.6085 (42a)
Hot water usage for baths	34.0323	33.5269	32.8151	31.5028	30.5201	29.4305	28.8420	29.5487	30.3183	31.4842	32.8236	33.9173 (42b)
Hot water usage for other uses	47.9814	46.2366	44.4918	42.7470	41.0023	39.2575	39.2575	41.0023	42.7470	44.4918	46.2366	47.9814 (42c)
Average daily hot water use (litres/day)												144.2238 (43)
Daily hot water use	156.9091	153.5334	149.4367	143.2415	138.1983	132.7813	130.7248	134.8041	139.1027	144.7863	151.0759	156.5071 (44)
Energy conte	248.5057	218.6295	229.6787	196.0905	186.0415	163.2701	158.1003	166.9156	171.5275	196.4736	215.2353	245.0523 (45)
Energy content (annual)												Total = Sum(45)m = 2395.5206
Distribution loss (46)m = 0.15 x (45)m	37.2759	32.7944	34.4518	29.4136	27.9062	24.4905	23.7150	25.0373	25.7291	29.4710	32.2853	36.7578 (46)
Water storage loss:												500.0000 (47)
Store volume												
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.6214 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.9376 (55)
Total storage loss	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650 (56)
If cylinder contains dedicated solar storage	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650 (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	331.8331	293.8930	313.0061	276.7300	269.3689	243.9096	241.4278	250.2430	252.1669	279.8010	295.8747	328.3797 (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 (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	331.8331	293.8930	313.0061	276.7300	269.3689	243.9096	241.4278	250.2430	252.1669	279.8010	295.8747	328.3797 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 3376.6338 (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	149.2901	132.9051	143.0301	129.7117	128.5207	118.7989	119.2303	122.1614	121.5444	131.9894	136.0773	148.1418 (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	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.2580	233.8928	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580	218.2999	211.2580	218.2999	211.2580 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	385.7693	389.7724	379.6848	358.2094	331.1006	305.6222	288.6010	284.5979	294.6855	316.1609	343.2697	368.7481 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120 (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)	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956 (71)
Water heating gains (Table 5)	200.6587	197.7754	192.2448	180.1551	172.7429	164.9984	160.2558	164.1954	168.8117	177.4051	188.9962	199.1154 (72)
Total internal gains	869.0219	892.7765	854.5234	828.0002	786.4374	757.2564	728.4506	728.3872	750.1331	776.1599	821.9017	850.4574 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)						
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)						
West	8.8600	19.6403	0.6300	0.7000	0.7700	53.1806 (80)						
Solar gains	142.0556	265.1298	422.7714	621.9698	784.4590	816.9335	771.7708	645.0276	491.0482	309.3498	174.4032	118.7980 (83)
Total gains	1011.0774	1157.9063	1277.2948	1449.9700	1570.8963	1574.1899	1500.2214	1373.4148	1241.1813	1085.5097	996.3049	969.2554 (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)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710
alpha	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781
util living area	0.9886	0.9809	0.9658	0.9228	0.8336	0.6857	0.5399	0.5990	0.8120	0.9458	0.9811	0.9902 (86)
MIT	19.3646	19.5358	19.8140	20.2029	20.5556	20.7863	20.8710	20.8530	20.6718	20.2195	19.7217	19.3246 (87)
Th 2	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533 (88)
util rest of house	0.9867	0.9776	0.9596	0.9080	0.8002	0.6224	0.4500	0.5093	0.7625	0.9324	0.9773	0.9885 (89)
MIT 2	18.1974	18.4155	18.7689	19.2562	19.6822	19.9375	20.0159	20.0027	19.8235	19.2837	18.6540	18.1463 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	18.5692	18.7724	19.1018	19.5578	19.9605	20.2079	20.2883	20.2736	20.0938	19.5818	18.9941	18.5217 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.5692	18.7724	19.1018	19.5578	19.9605	20.2079	20.2883	20.2736	20.0938	19.5818	18.9941	18.5217 (93)

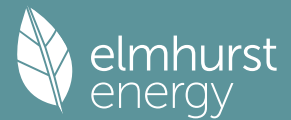
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9817	0.9706	0.9498	0.8955	0.7917	0.6268	0.4650	0.5229	0.7585	0.9212	0.9703	0.9841 (94)
Useful gains	992.6244	1123.8854	1213.1918	1298.4081	1243.6173	986.6381	697.6696	718.1053	941.4457	999.9570	966.7361	953.8279 (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	2822.0798	2743.5934	2492.3122	2107.8401	1633.7052	1109.0955	729.4466	766.0985	1185.4108	1776.3736	2352.3458	2832.4510 (97)
Space heating kWh	1361.1148	1088.4438	951.6655	582.7911	290.2254	0.0000	0.0000	0.0000	0.0000	577.6540	997.6390	1397.6956 (98a)
Space heating requirement - total per year (kWh/year)	7247.2292											
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	1361.1148	1088.4438	951.6655	582.7911	290.2254	0.0000	0.0000	0.0000	0.0000	577.6540	997.6390	1397.6956 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	7247.2292											
Space heating per m ²	(98c) / (4) = 33.5924 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	84.2000 (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

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Space heating requirement	1361.1148	1088.4438	951.6655	582.7911	290.2254	0.0000	0.0000	0.0000	0.0000	577.6540	997.6390	1397.6956	(98)
Space heating efficiency (main heating system 1)	84.2000	84.2000	84.2000	84.2000	84.2000	0.0000	0.0000	0.0000	0.0000	84.2000	84.2000	84.2000	(210)
Space heating fuel (main heating system)	1616.5259	1292.6886	1130.2441	692.1509	344.6857	0.0000	0.0000	0.0000	0.0000	686.0499	1184.8444	1659.9710	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	331.8331	293.8930	313.0061	276.7300	269.3689	243.9096	241.4278	250.2430	252.1669	279.8010	295.8747	328.3797	(64)
Efficiency of water heater (217)m	82.2802	82.1214	81.7895	81.0896	79.6285	75.2000	75.2000	75.2000	75.2000	81.0490	81.9676	82.3354	(216)
Fuel for water heating, kWh/month	403.2965	357.8762	382.6973	341.2645	338.2820	324.3478	321.0475	332.7700	335.3284	345.2246	360.9653	398.8316	(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 (235c)m	23.0209	20.7931	23.0209	22.2783	23.0209	22.2783	23.0209	23.0209	22.2783	23.0209	22.2783	23.0209	(231)
Lighting (233a)m	40.8448	32.7672	29.5032	21.6153	16.6963	13.6410	15.2309	19.7977	25.7153	33.7399	38.1091	41.9800	(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												8607.1605	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.2000	(216)
Water heating fuel used												4241.9316	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)													
mechanical ventilation fans (SFP = 0.2520)												185.0526	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												271.0526	(231)
Electricity for lighting (calculated in Appendix L)												329.6407	(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												13449.7854	(238)

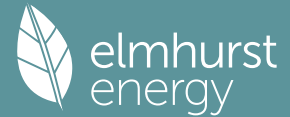
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	8607.1605	0.2100	1807.5037 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	4241.9316	0.2100	890.8056 (264)
Space and water heating			2698.3093 (265)
Pumps, fans and electric keep-hot	271.0526	0.1387	37.5983 (267)
Energy for lighting	329.6407	0.1443	47.5773 (268)
Total CO2, kg/year			2783.4850 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.9000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	8607.1605	1.1300	9726.0914 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4241.9316	1.1300	4793.3827 (278)
Space and water heating			14519.4741 (279)
Pumps, fans and electric keep-hot	271.0526	1.5128	410.0484 (281)
Energy for lighting	329.6407	1.5338	505.6139 (282)

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Total Primary energy kWh/year
Dwelling Primary energy Rate (DPER)

15435.1364 (286)
71.5500 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	215.7400 (1b)	x 2.7900 (2b)	= 601.9146 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	215.7400		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	601.9146 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0665 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3165 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165 (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 infilt rate												
Effective ac	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718 (22b)
	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			28.6000	1.1450	32.7481		(27)
UNHEATED SPACE BELOW			24.5600	0.1300	3.1928		(28a)
Heatloss Floor 1			108.3700	0.1300	14.0881		(28b)
EXTERNAL	112.5800	28.6000	83.9800	0.1800	15.1164		(29a)
HALLWAY	32.1700	2.9100	29.2600	0.1800	5.2668		(29a)
Flat Roof	30.5700		30.5700	0.1100	3.3627		(30)
Total net area of external elements Aum(A, m ²)			308.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6849		(33)
Party Wall 1			37.1900	0.0000	0.0000		(32)

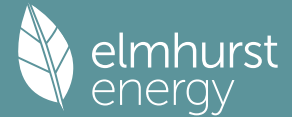
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

131.2549 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	16.6200	0.0500	0.8310
E3 Sill	9.3900	0.0500	0.4695
E4 Jamb	37.2800	0.0500	1.8640
E20 Exposed floor (normal)	30.2100	0.3200	9.6672
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.1400	0.0700	0.7098
E14 Flat roof	18.8800	0.0800	1.5104
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.9100	0.0000	0.0000

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P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228	
E18 Party wall between dwellings	11.1600	0.0600	0.6696	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				18.2491 (36)
Point Thermal bridges				0.0000 (36a) =
Total fabric heat loss				94.9340 (37) (33) + (36) + (36a) =

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	115.4841	114.8563	114.2409	111.3504	110.8096	108.2920	108.2920	107.8258	109.2618	110.8096	111.9036	113.0474 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	210.4181	209.7903	209.1749	206.2844	205.7436	203.2260	203.2260	202.7598	204.1957	205.7436	206.8376	207.9814 (39)
												206.2818
HLP	0.9753	0.9724	0.9696	0.9562	0.9537	0.9420	0.9420	0.9398	0.9465	0.9537	0.9587	0.9640 (40)
HLP (average)												0.9562
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

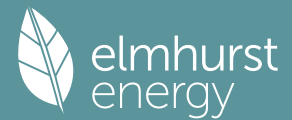
Assumed occupancy													3.0224 (42)
Hot water usage for mixer showers													74.6085 (42a)
Hot water usage for baths													32.2214 (42b)
Hot water usage for other uses													45.5823 (42c)
Average daily hot water use (litres/day)													140.4652 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	152.8084	149.5452	145.5714	139.5291	134.6222	129.3469	127.3198	131.2765	135.4494	140.9875	147.1229	152.4122 (44)	
Energy content (annual)	242.0112	212.9504	223.7378	191.0083	181.2273	159.0471	153.9823	162.5477	167.0226	191.3187	209.6035	238.6406 (45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2333.0976
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.9009 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.5665 (55)
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607 (56)
Combi loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607 (57)
Total heat required for water heating calculated for each month	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)
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 (61)
PV diverter	313.8343	277.8229	295.5609	260.5145	253.0504	228.5534	225.8054	234.3709	236.5289	263.1418	279.1098	310.4638 (62)	
Solar input	-34.2391	-30.2813	-31.7088	-26.2562	-24.4698	-20.9390	-19.6270	-20.8713	-21.6643	-25.5398	-28.9335	-33.6050 (63a)	
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 (63b)	
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 (63c)	
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 (64a)	
Electric shower(s)													0.0000 (64a)
Heat gains from water heating, kWh/month													0.0000 (64a)
	137.9272	122.7040	131.8513	119.1152	117.7166	108.4882	108.6576	111.5056	111.1400	121.0719	125.2982	136.8065 (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	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.2580	233.8928	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	385.7693	389.7724	379.6848	358.2094	331.1066	305.6222	288.6010	284.5979	294.6855	316.1609	343.2697	368.7481	368.7481 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120 (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)	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956 (71)
Water heating gains (Table 5)	185.3860	182.5952	177.2195	165.4378	158.2212	150.6780	146.0452	149.8731	154.3611	162.7311	174.0252	183.8797	183.8797 (72)
Total internal gains	853.7492	877.5963	839.4981	813.2830	771.9156	742.9359	714.2400	714.0649	735.6825	761.4859	806.9307	835.2217	835.2217 (73)

6. Solar gains

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[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North		17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
South		2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)
West		8.8600	19.6403	0.6300	0.7000	0.7700	53.1806 (80)

Solar gains	142.0556	265.1298	422.7714	621.9698	784.4590	816.9335	771.7708	645.0276	491.0482	309.3498	174.4032	118.7980 (83)
Total gains	995.8048	1142.7261	1262.2695	1435.2528	1556.3746	1559.8695	1486.0108	1359.0925	1226.7307	1070.8357	981.3339	954.0197 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.3818	37.4937	37.6040	38.1309	38.2312	38.7048	38.7048	38.7938	38.5209	38.2312	38.0289	37.8198
alpha	3.4921	3.4996	3.5069	3.5421	3.5487	3.5803	3.5803	3.5863	3.5681	3.5487	3.5353	3.5213
util living area	0.9912	0.9850	0.9725	0.9349	0.8528	0.7059	0.5586	0.6184	0.8317	0.9553	0.9852	0.9925 (86)
MIT	18.8816	19.1103	19.4837	20.0266	20.5053	20.8310	20.9458	20.9218	20.6712	20.0575	19.3920	18.8571 (87)
Th 2	20.1039	20.1064	20.1088	20.1200	20.1221	20.1320	20.1320	20.1338	20.1282	20.1221	20.1179	20.1134 (88)
util rest of house	0.9896	0.9822	0.9670	0.9211	0.8200	0.6405	0.4639	0.5246	0.7824	0.9432	0.9819	0.9911 (89)
MIT 2	17.5867	17.8799	18.3565	19.0460	19.6277	19.9960	20.1011	20.0858	19.8339	19.0943	18.2483	17.5613 (90)
Living area fraction									fLA = Living area / (4) =			0.3186 (91)
MIT	17.9992	18.2719	18.7156	19.3584	19.9073	20.2620	20.3702	20.3521	20.1007	19.4011	18.6127	17.9741 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9992	18.2719	18.7156	19.3584	19.9073	20.2620	20.3702	20.3521	20.1007	19.4011	18.6127	17.9741 (93)

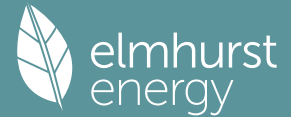
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9839	0.9740	0.9555	0.9063	0.8108	0.6511	0.4911	0.5497	0.7806	0.9303	0.9739	0.9860 (94)
Useful gains	979.7422	1112.9765	1206.0741	1300.7071	1261.9168	1015.5848	729.8060	747.0646	957.6304	996.1573	955.7515	940.6797 (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	2882.5580	2805.2978	2555.2014	2157.4004	1688.5962	1150.6611	766.1940	801.3282	1225.3105	1810.7774	2381.2564	2864.7530 (97)
Space heating kWh	1415.6950	1137.2399	1003.7507	616.8191	317.4495	0.0000	0.0000	0.0000	0.0000	606.0773	1026.3635	1431.5106 (98a)
Space heating requirement - total per year (kWh/year)												7554.9055
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	1415.6950	1137.2399	1003.7507	616.8191	317.4495	0.0000	0.0000	0.0000	0.0000	606.0773	1026.3635	1431.5106 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7554.9055
Space heating per m ²												(98c) / (4) = 35.0186 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1415.6950	1137.2399	1003.7507	616.8191	317.4495	0.0000	0.0000	0.0000	0.0000	606.0773	1026.3635	1431.5106 (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)	1533.7974	1232.1126	1087.4872	668.2764	343.9322	0.0000	0.0000	0.0000	0.0000	656.6385	1111.9865	1550.9324 (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	279.5953	247.5416	263.8521	234.2584	228.5806	207.6144	206.1785	213.4996	214.8646	237.6020	250.1763	276.8587 (64)
Efficiency of water heater (217)m	87.1784	87.0451	86.7632	86.1264	84.7965	79.8000	79.8000	79.8000	79.8000	86.0663	86.8797	79.8000 (216)
Fuel for water heating, kWh/month	320.7161	284.3831	304.1060	271.9938	269.5637	260.1684	258.3690	267.5433	269.2539	276.0684	287.9571	317.4764 (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	43.8952	35.2144	31.7067	23.2297	17.9433	14.6598	16.3684	21.2763	27.6358	36.2597	40.9552	45.1152 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233a)m	-52.9022	-75.8682	-110.8476	-126.6482	-138.1390	-129.3412	-127.6148	-119.6555	-105.9500	-87.5526	-58.5678	-45.5773	(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	-26.0693	-55.2502	-110.6306	-167.4070	-222.6508	-224.3285	-221.8240	-187.3306	-136.5733	-79.5745	-34.9747	-20.5945	(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												8185.1631	(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												3387.5992	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												354.2597	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2665.8725	(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												9347.1495	(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	8185.1631	0.2100	1718.8842 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3387.5992	0.2100	711.3958 (264)
Space and water heating			2430.2801 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	354.2597	0.1443	51.1306 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1178.6646	0.1343	-158.2602
PV Unit electricity exported	-1487.2079	0.1257	-186.8832
Total			-345.1435 (269)
Total CO2, kg/year			2148.1965 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	8185.1631	1.1300	9249.2343 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3387.5992	1.1300	3827.9871 (278)
Space and water heating			13077.2214 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	354.2597	1.5338	543.3754 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1178.6646	1.4962	-1763.5471
PV Unit electricity exported	-1487.2079	0.4612	-685.9712
Total			-2449.5184 (283)
Total Primary energy kWh/year			11301.1792 (286)
Target Primary Energy Rate (TPER)			52.3800 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 2 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	85 B	DER	12.90	TER	9.96
Environmental	86 B	% DER < TER			-29.52
CO ₂ Emissions (t/year)	2.63	DFEE	38.45	TFEE	39.40
Compliance Check	See BREL	% DFEE < TFEE			2.41
% DPER < TPER	-36.59	DPER	71.55	TPER	52.38
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	215.7400 (1b)	x 2.7900 (2b)	= 601.9146 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	215.7400		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 601.9146 (5)

2. Ventilation rate

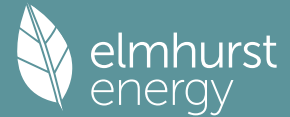
		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0665 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2165 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2165 (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	0.2760	0.2706	0.2652	0.2381	0.2327	0.2056	0.2056	0.2002	0.2165	0.2327	0.2435	0.2543 (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	0.5381	0.5366	0.5352	0.5283	0.5271	0.5211	0.5211	0.5200	0.5234	0.5271	0.5296	0.5323 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			28.6000	1.1450	32.7481		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
UNHEATED SPACE BELOW			24.5600	0.1308	3.2135	110.0000	2701.6000 (28a)
Heatloss Floor 1			108.3700	0.1292	13.9961		(28b)
EXTERNAL	112.5800	28.6000	83.9800	0.1800	15.1164	70.0000	5878.6000 (29a)
HALLWAY	32.1700	2.9100	29.2600	0.1700	4.9742	70.0000	2048.2000 (29a)

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Flat Roof	30.5700	30.5700	0.1100	3.3627	9.0000	275.1300 (30)
Total net area of external elements Aum(A, m2)		308.2500				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	76.9030			(33)
Party Wall 1		37.1900	0.0000	0.0000	180.0000	6694.2000 (32)
Party Floor 1		82.8100			40.0000	3312.4000 (32d)
Party Ceiling 1		185.1700			40.0000	7406.8000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28316.9300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 131.2549 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	16.6200	0.3000	4.9860
E3 Sill	9.3900	0.0400	0.3756
E4 Jamb	37.2800	0.0500	1.8640
E20 Exposed floor (normal)	30.2100	0.3200	9.6672
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.1400	0.0700	0.7098
E14 Flat roof	18.8800	0.0400	0.7552
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.5550 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 98.4580 (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	106.8803	106.5865	106.2986	104.9463	104.6933	103.5154	103.5154	103.2973	103.9691	104.6933	105.2051	105.7402 (38)
Average = Sum(39)m / 12 =	205.3383	205.0445	204.7566	203.4043	203.1512	201.9734	201.9734	201.7553	202.4271	203.1512	203.6631	204.1982 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9518	0.9504	0.9491	0.9428	0.9416	0.9362	0.9362	0.9352	0.9383	0.9416	0.9440	0.9465 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

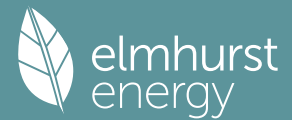
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0224 (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	32.3307	31.8505	31.1744	29.9277	28.9941	27.9590	27.3999	28.0713	28.8024	29.9100	31.1824	32.2214	(42b)
Hot water usage for other uses	45.5823	43.9248	42.2672	40.6097	38.9522	37.2946	37.2946	38.9522	40.6097	42.2672	43.9248	45.5823	(42c)
Average daily hot water use (litres/day)													71.4141 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	77.9130	75.7753	73.4416	70.5374	67.9463	65.2536	64.6945	67.0235	69.4121	72.1772	75.1072	77.8037	(44)
Energy content (annual)	123.3952	107.9030	112.8770	96.5621	91.4688	80.2369	78.2424	82.9890	85.5920	97.9438	107.0039	121.8218	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	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	0.0000 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
wwhrs	104.8859	91.7176	95.9455	82.0778	77.7485	68.2014	66.5060	70.5407	72.7532	83.2522	90.9533	103.5485	(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	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	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	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Total per year (kWh/year)	104.8859	91.7176	95.9455	82.0778	77.7485	68.2014	66.5060	70.5407	72.7532	83.2522	90.9533	103.5485	(64)
Electric shower(s)													1008.1306 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													1008 (64)
Heat gains from water heating, kWh/month	59.9788	53.4416	58.3561	55.6885	56.7335	54.1183	55.9222	56.7335	55.6885	58.3561	57.2588	59.9788	(64a)
	41.2162	36.2898	38.5754	34.4416	33.6205	30.5799	30.6071	31.8186	32.1104	35.4021	37.0530	40.8818	(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	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	211.2580	233.8928	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580	218.2999	211.2580	218.2999	211.2580	(67)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	385.7693	389.7724	379.6848	358.2094	331.1006	305.6222	288.6010	284.5979	294.6855	316.1609	343.2697	368.7481 (68)
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)	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956 (71)
Water heating gains (Table 5)	55.3981	54.0027	51.8487	47.8355	45.1888	42.4721	41.1385	42.7669	44.5978	47.5835	51.4626	54.9487 (72)
Total internal gains	720.7612	746.0037	711.1273	692.6807	655.8833	634.7301	609.3334	606.9586	625.9192	643.3382	681.3680	703.2907 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)
West	8.8600	19.6403	0.6300	0.7000	0.7700	53.1806 (80)

Solar gains	142.0556	265.1298	422.7714	621.9698	784.4590	816.9335	771.7708	645.0276	491.0482	309.3498	174.4032	118.7980 (83)
Total gains	862.8168	1011.1335	1133.8987	1314.6505	1440.3423	1451.6636	1381.1042	1251.9863	1116.9674	952.6880	855.7712	822.0887 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, ni1,m (see Table 9a)	38.3066	38.3615	38.4154	38.6708	38.7190	38.9448	38.9448	38.9869	38.8575	38.7190	38.6217	38.5205
tau	3.5538	3.5574	3.5610	3.5781	3.5813	3.5963	3.5963	3.5991	3.5905	3.5813	3.5748	3.5680
util living area	0.9944	0.9896	0.9797	0.9476	0.8736	0.7350	0.5893	0.6539	0.8601	0.9675	0.9903	0.9953 (86)
MIT	18.8288	19.0565	19.4296	19.9708	20.4655	20.8085	20.9366	20.9072	20.6302	19.9910	19.3210	18.7905 (87)
Th 2	20.1237	20.1249	20.1260	20.1313	20.1322	20.1368	20.1368	20.1377	20.1351	20.1322	20.1302	20.1282 (88)
util rest of house	0.9934	0.9877	0.9756	0.9361	0.8439	0.6713	0.4927	0.5595	0.8158	0.9583	0.9881	0.9945 (89)
MIT 2	18.1037	18.3312	18.7029	19.2389	19.7108	20.0148	20.1081	20.0922	19.8718	19.2652	18.5996	18.0686 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.3347	18.5623	18.9344	19.4721	19.9512	20.2676	20.3721	20.3519	20.1134	19.4965	18.8294	18.2986 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.3347	18.5623	18.9344	19.4721	19.9512	20.2676	20.3721	20.3519	20.1134	19.4965	18.8294	18.2986 (93)

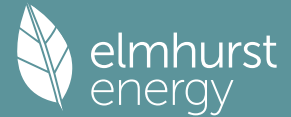
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9903	0.9828	0.9681	0.9253	0.8368	0.6818	0.5205	0.5847	0.8145	0.9496	0.9835	0.9918 (94)
Useful gains	854.4631	993.7492	1097.7054	1216.4911	1205.2484	989.6776	718.8467	732.0487	909.7400	904.6544	841.6470	815.3559 (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	2881.8601	2801.3762	2546.0247	2150.4023	1676.2460	1144.7116	761.8545	797.3085	1217.2767	1807.3254	2388.8542	2878.8991 (97)
Space heating kWh	1508.3834	1214.7254	1077.5495	672.4161	350.4222	0.0000	0.0000	0.0000	0.0000	671.5872	1113.9892	1535.2762 (98a)
Space heating requirement - total per year (kWh/year)	8144.3492											
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	1508.3834	1214.7254	1077.5495	672.4161	350.4222	0.0000	0.0000	0.0000	0.0000	671.5872	1113.9892	1535.2762 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8144.3492											
Space heating per m2	(98c) / (4) = 37.7508 (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	1898.5500	1494.6032	1533.3402	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7081	0.7866	0.7347	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1344.2920	1175.5999	1126.4987	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1588.5708	1510.5335	1364.0343	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	175.8807	249.1906	176.7266	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	43.9702	62.2976	44.1816	0.0000	0.0000	0.0000	0.0000 (107)

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Space cooling requirement	150.4495 (107)
Energy for space heating	37.7508 (99)
Energy for space cooling	0.6974 (108)
Total	38.4481 (109)
Fabric Energy Efficiency (DFEE)	38.4 (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	215.7400 (1b)	2.7900 (2b)	601.9146 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	215.7400		601.9146 (4)
Dwelling volume			601.9146 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0665 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3165 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3165 (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 infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718 (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	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			28.6000	1.1450	32.7481		(27)
UNHEATED SPACE BELOW			24.5600	0.1300	3.1928		(28a)
Heatloss Floor 1			108.3700	0.1300	14.0881		(28b)
EXTERNAL	112.5800	28.6000	83.9800	0.1800	15.1164		(29a)
HALLWAY	32.1700	2.9100	29.2600	0.1800	5.2668		(29a)
Flat Roof	30.5700		30.5700	0.1100	3.3627		(30)
Total net area of external elements Aum(A, m2)			308.2500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 76.6849		(33)
Party Wall 1			37.1900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 131.2549 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	16.6200	0.0500	0.8310
E3 Sill	9.3900	0.0500	0.4695
E4 Jamb	37.2800	0.0500	1.8640
E20 Exposed floor (normal)	30.2100	0.3200	9.6672
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048

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E7 Party floor between dwellings (in blocks of flats)	10.1400	0.0700	0.7098
E14 Flat roof	18.8800	0.0800	1.5104
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.2491 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	94.9340 (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	115.4841	114.8563	114.2409	111.3504	110.8096	108.2920	108.2920	107.8258	109.2618	110.8096	111.9036	113.0474 (38)
Heat transfer coeff	210.4181	209.7903	209.1749	206.2844	205.7436	203.2260	203.2260	202.7598	204.1957	205.7436	206.8376	207.9814 (39)
Average = Sum(39)m / 12 =												206.2818

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9753	0.9724	0.9696	0.9562	0.9537	0.9420	0.9420	0.9398	0.9465	0.9537	0.9587	0.9640 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

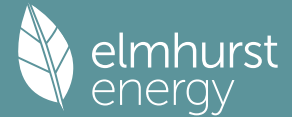
Assumed occupancy													3.0224 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.3307	31.8505	31.1744	29.9277	28.9941	27.9590	27.3999	28.0713	28.8024	29.9100	31.1824	32.2214	(42b)
Hot water usage for other uses	45.5823	43.9248	42.2672	40.6097	38.9522	37.2946	37.2946	38.9522	40.6097	42.2672	43.9248	45.5823	(42c)
Average daily hot water use (litres/day)													71.4141 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	77.9130	75.7753	73.4416	70.5374	67.9463	65.2536	64.6945	67.0235	69.4121	72.1772	75.1072	77.8037	(44)
Energy content (annual)	123.3952	107.9030	112.8770	96.5621	91.4688	80.2369	78.2424	82.9890	85.5920	97.9438	107.0039	121.8218	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	104.8859	91.7176	95.9455	82.0778	77.7485	68.2014	66.5060	70.5407	72.7532	83.2522	90.9533	103.5485	(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	104.8859	91.7176	95.9455	82.0778	77.7485	68.2014	66.5060	70.5407	72.7532	83.2522	90.9533	103.5485	(64)
12Total per year (kWh/year)													1008.1306 (64)
Electric shower(s)	59.9788	53.4416	58.3561	55.6885	56.7335	54.1183	55.9222	56.7335	55.6885	58.3561	57.2588	59.9788	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													682.2548 (64a)
Heat gains from water heating, kWh/month	41.2162	36.2898	38.5754	34.4416	33.6205	30.5799	30.6071	31.8186	32.1104	35.4021	37.0530	40.8818	(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	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.2580	233.8928	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580	218.2999	211.2580	218.2999	211.2580	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	385.7693	389.7724	379.6848	358.2094	331.1006	305.6222	288.6010	284.5979	294.6855	316.1609	343.2697	368.7481	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	(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)	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	(71)
Water heating gains (Table 5)	55.3981	54.0027	51.8487	47.8355	45.1888	42.4721	41.1385	42.7669	44.5978	47.5835	51.4626	54.9487	(72)
Total internal gains	720.7612	746.0037	711.1273	692.6807	655.8833	634.7301	609.3334	606.9586	625.9192	643.3382	681.3680	703.2907	(73)

6. Solar gains

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[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North		17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
South		2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)
West		8.8600	19.6403	0.6300	0.7000	0.7700	53.1806 (80)

Solar gains	142.0556	265.1298	422.7714	621.9698	784.4590	816.9335	771.7708	645.0276	491.0482	309.3498	174.4032	118.7980 (83)
Total gains	862.8168	1011.1335	1133.8987	1314.6505	1440.3423	1451.6636	1381.1042	1251.9863	1116.9674	952.6880	855.7712	822.0887 (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, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.3818	37.4937	37.6040	38.1309	38.2312	38.7048	38.7048	38.7938	38.5209	38.2312	38.0289	37.8198
alpha	3.4921	3.4996	3.5069	3.5421	3.5487	3.5803	3.5803	3.5863	3.5681	3.5487	3.5353	3.5213
util living area	0.9944	0.9897	0.9799	0.9483	0.8756	0.7369	0.5917	0.6557	0.8616	0.9678	0.9903	0.9953 (86)
MIT	18.7734	19.0055	19.3859	19.9465	20.4495	20.8044	20.9348	20.9053	20.6223	19.9723	19.2915	18.7489 (87)
Th 2	20.1039	20.1064	20.1088	20.1200	20.1221	20.1320	20.1320	20.1338	20.1282	20.1221	20.1179	20.1134 (88)
util rest of house	0.9933	0.9877	0.9758	0.9369	0.8460	0.6730	0.4945	0.5610	0.8174	0.9587	0.9881	0.9944 (89)
MIT 2	18.0346	18.2675	18.6473	19.2069	19.6881	20.0073	20.1024	20.0874	19.8592	19.2395	18.5615	18.0168 (90)
Living area fraction									flA = Living area / (4) =			
MIT	18.2700	18.5026	18.8826	19.4425	19.9307	20.2612	20.3676	20.3480	20.1023	19.4730	18.7941	18.2501 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2700	18.5026	18.8826	19.4425	19.9307	20.2612	20.3676	20.3480	20.1023	19.4730	18.7941	18.2501 (93)

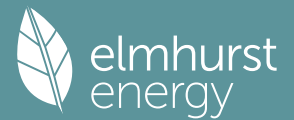
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9902	0.9827	0.9682	0.9260	0.8385	0.6834	0.5224	0.5862	0.8158	0.9498	0.9834	0.9917 (94)
Useful gains	854.3500	993.6750	1097.8406	1217.3281	1207.7723	992.0630	721.4229	733.8743	911.2487	904.8985	841.6002	815.2752 (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	2939.5312	2853.7020	2590.1310	2174.7507	1693.4041	1150.5064	765.6757	800.4893	1225.6457	1825.5530	2418.7694	2922.1489 (97)
Space heating kWh	1551.3749	1249.9382	1110.2640	689.3443	361.3101	0.0000	0.0000	0.0000	0.0000	684.9670	1135.5618	1567.5140 (98a)
Space heating requirement - total per year (kWh/year)												8350.2742
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	1551.3749	1249.9382	1110.2640	689.3443	361.3101	0.0000	0.0000	0.0000	0.0000	684.9670	1135.5618	1567.5140 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8350.2742
Space heating per m2												(98c) / (4) = 38.7053 (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	1910.3246	1503.8726	1540.9746	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7047	0.7834	0.7320	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1346.1916	1178.1315	1127.9827	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1588.5708	1510.5335	1364.0343	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	174.5130	247.3071	175.6225	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	43.6283	61.8268	43.9056	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												149.3606 (107)
Energy for space heating												38.7053 (99)
Energy for space cooling												0.6923 (108)
Total												39.3976 (109)
Fabric Energy Efficiency (TFEE)												39.4 (109)

Predicted Energy Assessment

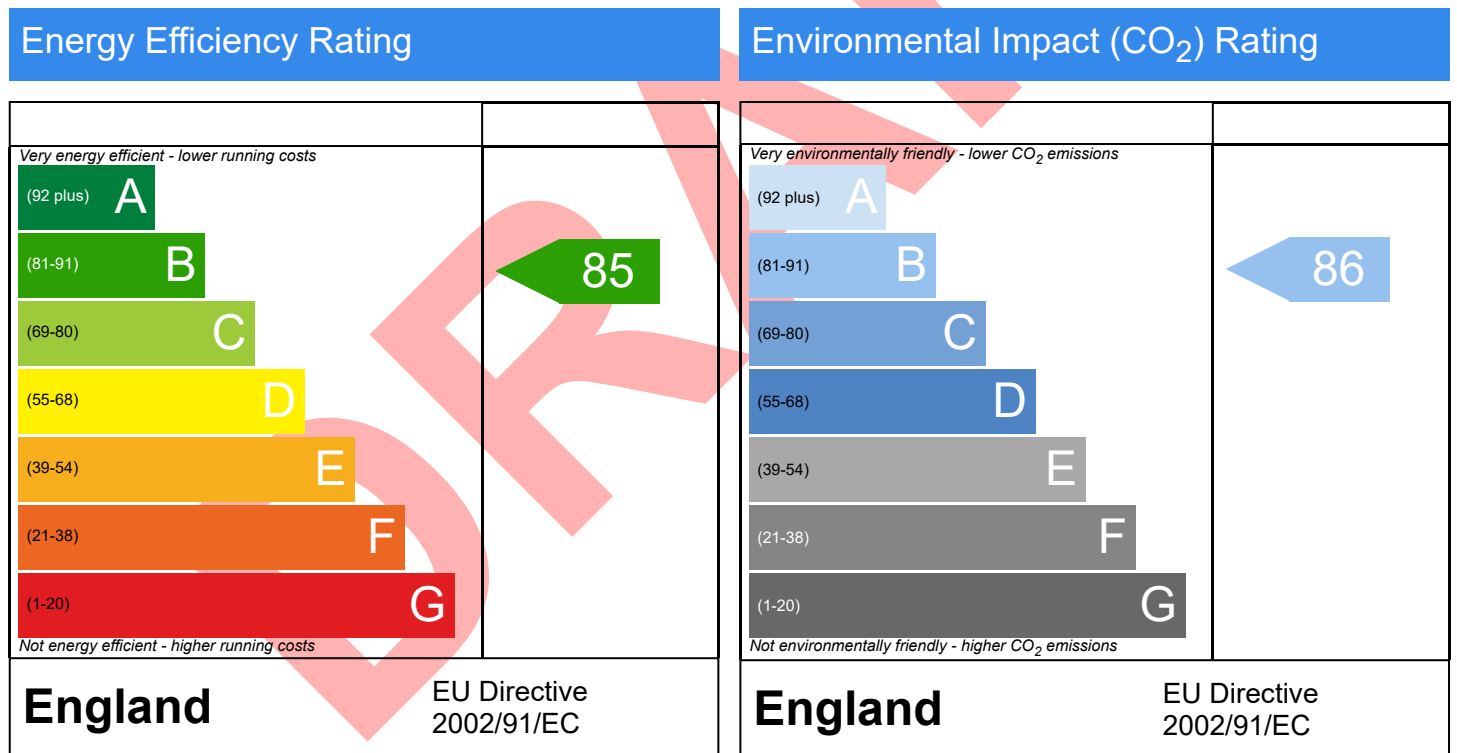


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Semi-Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 215.74 m²
 DRRN:

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.

Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Semi-Detached
Floor Area [m ²]	216

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

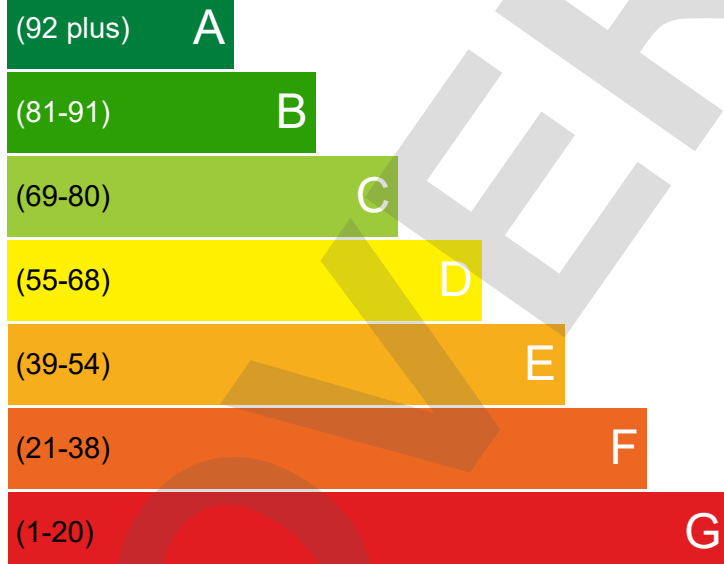
Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL



85

85

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.13 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 68 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **2.6** per year

With the recommended measures the potential CO emissions could be: **3** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£809

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:05

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Semi-detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	216 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 2 - Heatpump + PV
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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	9.96 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	1.71 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	52.38 kWh _{PE} /m ²		
Dwelling primary energy	17.44 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	39.4 kWh/m ²		
Dwelling fabric energy efficiency	38.4 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.14	Heatloss Floor 1 (0.14)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	WEST (1.2)	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)	83.98	0.18
Sheltered wall: Walls (2)	29.26	0.18
Party wall: Party Wall (1)	37.19	0 (!)
Upper floor: Heatloss Floor 1, Heatloss Floor 1	108.37	0.14
Exposed roof: Roof (1)	30.57	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
WEST, Windows	8.86	West	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	East	N/A	1.2
SOUTH, Windows	2.24	South	0.7	1.2
NORTH, Windows	17.5	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.32	
External wall	E21: Exposed floor (inverted)	Calculated by person with suitable expertise	0.32	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

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		3 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	441.4%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	MIDEA
Model	MHC-V16W/D2N8-B
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	500 litres
Declared heat loss	2.1 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		

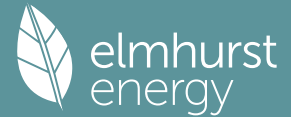
9 Local generation	
Technology type: Photovoltaic system (1)	
Peak power	1.79 kWp
Orientation	South
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks	
N/A	

11 Supporting documentary evidence	
N/A	

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:
b. Client Declaration	
N/A	

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 2 - Heatpump + PV	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	91 B	DER	1.71	TER	9.96
Environmental	98 A	% DER < TER			82.83
CO ₂ Emissions (t/year)	0.34	DFEE	38.45	TFEE	39.40
Compliance Check	See BREL	% DFEE < TFEE			2.41
% DPER < TPER	66.70	DPER	17.44	TPER	52.38

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
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	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	215.74 m ²	2.79 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	68.73	m ²
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9.0 External Walls	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
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	112.58	83.98	0.00	None	28.60	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	32.17	29.26	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	37.19	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	30.57	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	185.17

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Exposed Floor - Solid	Lowest occupied	Other	0.14	Garage Double 1 Inside	0.60	0.00	108.37
UNHEATED SPACE BELOW	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.14	Stairwell Access Corridor 1	0.50	110.00	24.56

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	82.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
WEST	Windows	EXTERNAL	West	8.86	0
ENTRANCE DOOR	Entrance Door	HALLWAY	East	2.91	0
SOUTH	Windows	EXTERNAL	South	2.24	0
NORTH	Windows	EXTERNAL	North	17.50	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	16.62	0.30	0.30	No
E3 Sill	Independently assessed	9.39	0.04	0.04	No
E4 Jamb	Independently assessed	37.28	0.05	0.05	No
E20 Exposed floor (normal)	Independently assessed	30.21	0.32	0.32	No
E21 Exposed floor (inverted)	Independently assessed	6.89	0.32	0.32	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	10.14	0.07	0.07	No
E14 Flat roof	Independently assessed	18.88	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.74	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	16.74	-0.09	-0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	28.91	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	2.69	0.12	0.12	No
E18 Party wall between dwellings	Independently assessed	11.16	0.06	0.06	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP ₅₀	<input type="text" value="3.00"/>	m³/(h.m²) @ 50 Pa
Property Tested?	<input type="text" value="Yes"/>	
Test Method	<input type="text" value="Blower Door"/>	
As Built AP ₅₀	<input type="text" value="0.10"/>	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	<input type="text" value="Yes"/>
Approved Installation	<input type="text" value="No"/>
Mechanical Ventilation data Type	<input type="text" value="Database"/>
Type	<input type="text" value="Mechanical extract ventilation - centralised"/>
MV Reference Number	<input type="text" value="500808"/>
Configuration	<input type="text" value="4"/>
Manufacturer SFP	<input type="text" value="0.18"/>
Duct Type	<input type="text" value="Rigid"/>

Summary for Input Data



MVHR Efficiency	<input type="text" value="0.00"/>
Wet Rooms	<input type="text" value="4"/>
SFP from Installer Commissioning Certificate	<input type="text" value="No"/>

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Database	<input type="text" value="Database"/>
Percentage of Heat	<input type="text" value="100.00"/> %
Database Ref. No.	<input type="text" value="105566"/>
Fuel Type	<input type="text" value="Electricity"/>
SAP Code	<input type="text" value="0"/>
In Winter	<input type="text" value="0.00"/>
In Summer	<input type="text" value="0.00"/>
Model Name	<input type="text" value="MHC-V16W/D2N8-B"/>
Manufacturer	<input type="text" value="MIDEA"/>
System Type	<input type="text" value="Heat Pump"/>
Controls SAP Code	<input type="text" value="2207"/>
Delayed Start Stat	<input type="text" value="No"/>
Burner Control	<input type="text" value="Modulating"/>
HETAS approved System	<input type="text" value="No"/>
Oil Pump Inside	<input type="text" value="No"/>
FI Case	<input type="text" value="0.00"/>
Flue Type	<input type="text" value="None or Unknown"/>
Fan Assisted Flue	<input type="text" value="No"/>
Is MHS Pumped	<input type="text" value="Pump in heated space"/>
Heating Pump Age	<input type="text" value="2013 or later"/>
Heat Emitter	<input type="text" value="Radiators and Underfloor"/>
Underfloor Heating	<input type="text" value="Yes - Pipes in thin screed"/>
Flow Temperature	<input type="text" value="Enter value"/>
Flow Temperature Value	<input type="text" value="35.00"/>
Boiler Interlock	<input type="text" value="No"/>
Combi boiler type	<input type="text" value="No Combi"/>
Combi keep hot type	<input type="text" value="None"/>

25.0 Main Heating 2

26.0 Heat Networks

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating	<input type="text" value="Main Heating 1"/>
SAP Code	<input type="text" value="901"/>
Flue Gas Heat Recovery System	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 1	<input type="text" value="No"/>

Summary for Input Data

Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No
Summer Immersion	No
Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Insulation Thickness Type	80 mm	
Insulation Thickness	80	
Cylinder Volume	500.00	L
Loss	2.10	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store

None

32.0 Photovoltaic Unit

One Dwelling	
Export Capable Meter?	No
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
1.79	South	30°	None Or Little	No	No	1.00		PV

34.0 Small-scale Hydro

None											
Electricity Generated	0.00										
Apportioned	0.00	kWh/Year									
Connected to dwelling's electricity meter	Yes										
Electricity Generation	Annual										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

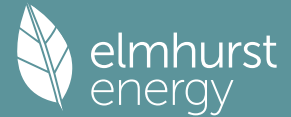
Lower cost measures

None

Further measures to achieve even higher standards

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

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 2 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	91 B	DER	1.71	TER	9.96
Environmental	98 A	% DER < TER			82.83
CO ₂ Emissions (t/year)	0.34	DFEE	38.45	TFEE	39.40
Compliance Check	See BREL	% DFEE < TFEE			2.41
% DPER < TPER	66.70	DPER	17.44	TPER	52.38
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	215.7400 (1b)	2.7900 (2b)	601.9146 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	215.7400		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 601.9146 (5)

2. Ventilation rate

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

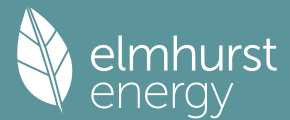
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			28.6000	1.1450	32.7481		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
UNHEATED SPACE BELOW			24.5600	0.1308	3.2135	110.0000	2701.6000 (28a)
Heatloss Floor 1			108.3700	0.1292	13.9961		(28b)

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EXTERNAL	112.5800	28.6000	83.9800	0.1800	15.1164	70.0000	5878.6000 (29a)
HALLWAY	32.1700	2.9100	29.2600	0.1700	4.9742	70.0000	2048.2000 (29a)
Flat Roof	30.5700		30.5700	0.1100	3.3627	9.0000	275.1300 (30)
Total net area of external elements Aum(A, m2)			308.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.9030		(33)
Party Wall 1			37.1900	0.0000	0.0000	180.0000	6694.2000 (32)
Party Floor 1			82.8100			40.0000	3312.4000 (32d)
Party Ceiling 1			185.1700			30.0000	5555.1000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 26465.2300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 122.6719 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	16.6200	0.3000	4.9860
E3 Sill	9.3900	0.0400	0.3756
E4 Jamb	37.2800	0.0500	1.8640
E20 Exposed floor (normal)	30.2100	0.3200	9.6672
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.1400	0.0700	0.7098
E14 Flat roof	18.8800	0.0400	0.7552
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			21.5550 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 98.4580 (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	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159	99.3159 (38)
Average = Sum(39)m / 12 =	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739	197.7739 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167	0.9167 (40)
HLP (average)												0.9167
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

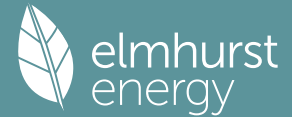
4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0224 (42)

Hot water usage for mixer showers	74.8954	73.7699	72.1298	68.9917	66.6759	64.0933	62.6253	64.2531	66.0373	68.8102	72.0157	74.6085 (42a)
Hot water usage for baths	34.0323	33.5269	32.8151	31.5028	30.5201	29.4305	28.8420	29.5487	30.3183	31.4842	32.8236	33.9173 (42b)
Hot water usage for other uses	47.9814	46.2366	44.4918	42.7470	41.0023	39.2575	39.2575	41.0023	42.7470	44.4918	46.2366	47.9814 (42c)
Average daily hot water use (litres/day)												144.2238 (43)
Daily hot water use	156.9091	153.5334	149.4367	143.2415	138.1983	132.7813	130.7248	134.8041	139.1027	144.7863	151.0759	156.5071 (44)
Energy conte	248.5057	218.6295	229.6787	196.0905	186.0415	163.2701	158.1003	166.9156	171.5275	196.4736	215.2353	245.0523 (45)
Energy content (annual)												Total = Sum(45)m = 2395.5206
Distribution loss (46)m = 0.15 x (45)m	37.2759	32.7944	34.4518	29.4136	27.9062	24.4905	23.7150	25.0373	25.7291	29.4710	32.2853	36.7578 (46)
Water storage loss:												500.0000 (47)
Store volume												2.1000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.1340 (55)
Enter (49) or (54) in (55)												
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	306.9221	271.3927	288.0951	252.6225	244.4579	219.8021	216.5167	225.3320	228.0595	254.8900	271.7673	303.4687 (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	306.9221	271.3927	288.0951	252.6225	244.4579	219.8021	216.5167	225.3320	228.0595	254.8900	271.7673	303.4687 (64)
Total per year (kWh/year) = Sum(64)m =												3083.3266 (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	129.3613	114.9049	123.1013	110.4257	108.5919	99.5129	99.3015	102.2326	102.2585	112.0606	116.7913	128.2130 (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	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.2580	233.8928	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580	218.2999	211.2580	218.2999	211.2580 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	385.7693	389.7724	379.6848	358.2094	331.1006	305.6222	288.6010	284.5979	294.6855	316.1609	343.2697	368.7481 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120 (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)	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956 (71)
Water heating gains (Table 5)	173.8727	170.9894	165.4587	153.3690	145.9569	138.2124	133.4697	137.4093	142.0257	150.6191	162.2102	172.3293 (72)
Total internal gains	839.2358	862.9904	824.7373	798.2142	756.6513	730.4703	701.6646	701.6011	723.3470	746.3738	792.1157	820.6713 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)
West	8.8600	19.6403	0.6300	0.7000	0.7700	53.1806 (80)

Solar gains	142.0556	265.1298	422.7714	621.9698	784.4590	816.9335	771.7708	645.0276	491.0482	309.3498	174.4032	118.7980 (83)
Total gains	981.2914	1128.1202	1247.5087	1420.1840	1541.1103	1547.4039	1473.4354	1346.6288	1214.3952	1055.7236	966.5189	939.4693 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710	37.1710 (85)
tau	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781	3.4781
util living area	0.9896	0.9823	0.9680	0.9267	0.8398	0.6932	0.5478	0.6079	0.8196	0.9496	0.9827	0.9911 (86)
Living	19.3455	19.5172	19.7965	20.1881	20.5454	20.7818	20.8691	20.8502	20.6634	20.2034	19.7031	19.3053
Non living	18.1730	18.3920	18.7470	19.2384	19.6709	19.9334	20.0146	20.0008	19.8150	19.2640	18.6305	18.1218
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1536	19.5172	19.7965	20.1881	20.5454	20.7818	20.8691	20.8502	20.6634	20.2034	19.7031	19.5424 (87)
Th 2	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533	20.1533 (88)
util rest of house	0.9878	0.9793	0.9621	0.9124	0.8072	0.6301	0.4572	0.5177	0.7711	0.9371	0.9792	0.9896 (89)
MIT 2	19.3638	18.3920	18.7470	19.2384	19.6709	19.9334	20.0146	20.0008	19.8150	19.2640	18.6305	18.4879 (90)
Living area fraction									fLA = Living area / (4) =			0.3186 (91)
MIT	19.6154	18.7505	19.0813	19.5410	19.9495	20.2037	20.2869	20.2714	20.0853	19.5632	18.9722	18.8238 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6154	18.7505	19.0813	19.5410	19.9495	20.2037	20.2869	20.2714	20.0853	19.5632	18.9722	18.8238 (93)

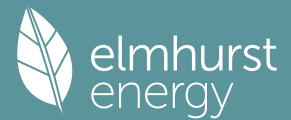
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9865	0.9726	0.9527	0.9000	0.7983	0.6341	0.4723	0.5312	0.7667	0.9261	0.9726	0.9864 (94)
Useful gains	968.0464	1097.2111	1188.4731	1278.1907	1230.2558	981.2716	695.8478	715.2907	931.0216	977.6606	940.0745	926.6864 (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	3028.9941	2739.2577	2488.2594	2104.5045	1631.5405	1108.2626	729.1658	765.6634	1183.7311	1772.6957	2348.0114	2892.2054 (97)
Space heating kWh	1533.3451	1103.4553	967.0410	594.9459	298.5558	0.0000	0.0000	0.0000	0.0000	591.5061	1013.7146	1462.3461 (98a)
Space heating requirement - total per year (kWh/year)												7564.9100
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	1533.3451	1103.4553	967.0410	594.9459	298.5558	0.0000	0.0000	0.0000	0.0000	591.5061	1013.7146	1462.3461 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7564.9100
Space heating per m2										(98c) / (4) =		35.0649 (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 %)	441.4457 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1533.3451	1103.4553	967.0410	594.9459	298.5558	0.0000	0.0000	0.0000	0.0000	591.5061	1013.7146	1462.3461	(98)
Space heating efficiency (main heating system 1)	441.4457	441.4457	441.4457	441.4457	441.4457	0.0000	0.0000	0.0000	0.0000	441.4457	441.4457	441.4457	(210)
Space heating fuel (main heating system)	347.3463	249.9640	219.0623	134.7722	67.6314	0.0000	0.0000	0.0000	0.0000	133.9930	229.6352	331.2630	(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	306.9221	271.3927	288.0951	252.6225	244.4579	219.8021	216.5167	225.3320	228.0595	254.8900	271.7673	303.4687	(64)
Efficiency of water heater (217)m	285.8556	285.8556	285.8556	285.8556	285.8556	285.8556	285.8556	285.8556	285.8556	285.8556	285.8556	285.8556	(216)
Fuel for water heating, kWh/month	107.3696	94.9405	100.7835	88.3742	85.5180	76.8927	75.7434	78.8272	79.7814	89.1674	95.0715	106.1616	(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	15.7168	14.1958	15.7168	15.2098	15.7168	15.2098	15.7168	15.7168	15.2098	15.7168	15.2098	15.7168	(231)
Lighting	40.8448	32.7672	29.5032	21.6153	16.6963	13.6410	15.2309	19.7977	25.7153	33.7399	38.1091	41.9800	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-36.1634	-55.0825	-85.3748	-102.1748	-113.8257	-104.0742	-102.6651	-94.1413	-79.8227	-64.8726	-40.8778	-30.7174	(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													1713.6673 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													285.8556
Water heating fuel used													1078.6310 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520) mechanical ventilation fans (SFP = 0.2520)													185.0526 (230a)
Total electricity for the above, kWh/year													185.0526 (231)
Electricity for lighting (calculated in Appendix L)													329.6407 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-909.7922 (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													2397.1995 (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	1713.6673	0.1548	265.2218	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1078.6310	0.1409	152.0210	(264)
Space and water heating			417.2428	(265)
Pumps, fans and electric keep-hot	185.0526	0.1387	25.6691	(267)
Energy for lighting	329.6407	0.1443	47.5773	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-909.7922	0.1336	-121.5752	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-121.5752	(269)
Total CO2, kg/year			368.9140	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

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Space heating - main system 1	1713.6673	1.5730	2695.5433 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1078.6310	1.5211	1640.7516 (278)
Space and water heating			4336.2949 (279)
Pumps, fans and electric keep-hot	185.0526	1.5128	279.9476 (281)
Energy for lighting	329.6407	1.5338	505.6139 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-909.7922	1.4938	-1359.0741
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1359.0741 (283)
Total Primary energy kWh/year			3762.7824 (286)
Dwelling Primary energy Rate (DPER)			17.4400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	215.7400 (1b)	x 2.7900 (2b)	= 601.9146 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	215.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 601.9146 (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		4 * 10 = 40.0000 (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 40.0000 / (5) = 0.0665 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3165 (18)
Number of sides sheltered		0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) = 0.3165 (21)

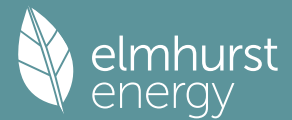
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718 (22b)
	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			28.6000	1.1450	32.7481		(27)
UNHEATED SPACE BELOW			24.5600	0.1300	3.1928		(28a)
Heatloss Floor 1			108.3700	0.1300	14.0881		(28b)
EXTERNAL	112.5800	28.6000	83.9800	0.1800	15.1164		(29a)
HALLWAY	32.1700	2.9100	29.2600	0.1800	5.2668		(29a)
Flat Roof	30.5700		30.5700	0.1100	3.3627		(30)
Total net area of external elements Aum(A, m ²)			308.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6849		(33)
Party Wall 1			37.1900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 131.2549 (35)
List of Thermal Bridges

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	Length	Psi-value	Total
K1 Element	16.6200	0.0500	0.8310
E2 Other lintels (including other steel lintels)	9.3900	0.0500	0.4695
E3 Sill	37.2800	0.0500	1.8640
E4 Jamb	30.2100	0.3200	9.6672
E20 Exposed floor (normal)	6.8900	0.3200	2.2048
E21 Exposed floor (inverted)	10.1400	0.0700	0.7098
E7 Party floor between dwellings (in blocks of flats)	18.8800	0.0800	1.5104
E14 Flat roof	16.7400	0.0900	1.5066
E16 Corner (normal)	16.7400	-0.0900	-1.5066
E17 Corner (inverted - internal area greater than external area)	28.9100	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	2.6900	0.1200	0.3228
P4 Party wall - Roof (insulation at ceiling level)	11.1600	0.0600	0.6696
E18 Party wall between dwellings			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			18.2491 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			94.9340 (37) (33) + (36) + (36a) =

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	115.4841	114.8563	114.2409	111.3504	110.8096	108.2920	108.2920	107.8258	109.2618	110.8096	111.9036	113.0474 (38)
Heat transfer coeff	210.4181	209.7903	209.1749	206.2844	205.7436	203.2260	203.2260	202.7598	204.1957	205.7436	206.8376	207.9814 (39)
Average = Sum(39)m / 12 =												206.2818

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9753	0.9724	0.9696	0.9562	0.9537	0.9420	0.9420	0.9398	0.9465	0.9537	0.9587	0.9640 (40)
HLP (average)												0.9562
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

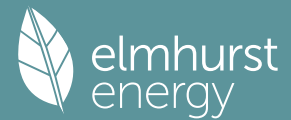
Assumed occupancy													3.0224 (42)
Hot water usage for mixer showers	74.8954	73.7699	72.1298	68.9917	66.6759	64.0933	62.6253	64.2531	66.0373	68.8102	72.0157	74.6085 (42a)	
Hot water usage for baths	32.3307	31.8505	31.1744	29.9277	28.9941	27.9590	27.3999	28.0713	28.8024	29.9100	31.1824	32.2214 (42b)	
Hot water usage for other uses	45.5823	43.9248	42.2672	40.6097	38.9522	37.2946	37.2946	38.9522	40.6097	42.2672	43.9248	45.5823 (42c)	
Average daily hot water use (litres/day)												140.4652 (43)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.8084	149.5452	145.5714	139.5291	134.6222	129.3469	127.3198	131.2765	135.4494	140.9875	147.1229	152.4122 (44)	
Energy conte	242.0112	212.9504	223.7378	191.0083	181.2273	159.0471	153.9823	162.5477	167.0226	191.3187	209.6035	238.6406 (45)	
Energy content (annual)												2333.0976	
Distribution loss (46)m = 0.15 x (45)m	36.3017	31.9426	33.5607	28.6512	27.1841	23.8571	23.0973	24.3822	25.0534	28.6978	31.4405	35.7961 (46)	
Water storage loss:													500.0000 (47)
Store volume													2.9009 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.5665 (55)
Enter (49) or (54) in (55)													
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (56)	
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (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	313.8343	277.8229	295.5609	260.5145	253.0504	228.5534	225.8054	234.3709	236.5289	263.1418	279.1098	310.4638 (62)	
WVHRS	-34.2391	-30.2813	-31.7088	-26.2562	-24.4698	-20.9390	-19.6270	-20.8713	-21.6643	-25.5398	-28.9335	-33.6050 (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	279.5953	247.5416	263.8521	234.2584	228.5806	207.6144	206.1785	213.4996	214.8646	237.6020	250.1763	276.8587 (64)	
Total per year (kWh/year) = Sum(64)m =												2860.6218 (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	137.9272	122.7040	131.8513	119.1152	117.7166	108.4882	108.6576	111.5056	111.1400	121.0719	125.2982	136.8065 (65)	

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.2580	233.8928	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580	218.2999	211.2580	218.2999	211.2580 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	385.7693	389.7724	379.6848	358.2094	331.1006	305.6222	288.6010	284.5979	294.6855	316.1609	343.2697	368.7481 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956 (71)

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Water heating gains (Table 5)	185.3860	182.5952	177.2195	165.4378	158.2212	150.6780	146.0452	149.8731	154.3611	162.7311	174.0252	183.8797 (72)
Total internal gains	853.7492	877.5963	839.4981	813.2830	771.9156	742.9359	714.2400	714.0649	735.6825	761.4859	806.9307	835.2217 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	17.5000	10.6334	0.6300	0.7000	0.7000	0.7700	56.8698 (74)	
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)		
West	8.8600	19.6403	0.6300	0.7000	0.7700	53.1806 (80)		

Solar gains	142.0556	265.1298	422.7714	621.9698	784.4590	816.9335	771.7708	645.0276	491.0482	309.3498	174.4032	118.7980 (83)
Total gains	995.8048	1142.7261	1262.2695	1435.2528	1556.3746	1559.8695	1486.0108	1359.0925	1226.7307	1070.8357	981.3339	954.0197 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.3818	37.4937	37.6040	38.1309	38.2312	38.7048	38.7048	38.7938	38.5209	38.2312	38.0289	37.8198
alpha	3.4921	3.4996	3.5069	3.5421	3.5487	3.5803	3.5803	3.5863	3.5681	3.5487	3.5353	3.5213
util living area	0.9912	0.9850	0.9725	0.9349	0.8528	0.7059	0.5586	0.6184	0.8317	0.9553	0.9852	0.9925 (86)
MIT	18.8816	19.1103	19.4837	20.0266	20.5053	20.8310	20.9458	20.9218	20.6712	20.0575	19.3920	18.8571 (87)
Th 2	20.1039	20.1064	20.1088	20.1200	20.1221	20.1320	20.1320	20.1338	20.1282	20.1221	20.1179	20.1134 (88)
util rest of house	0.9896	0.9822	0.9670	0.9211	0.8200	0.6405	0.4639	0.5246	0.7824	0.9432	0.9819	0.9911 (89)
MIT 2	17.5867	17.8799	18.3565	19.0460	19.6277	19.9960	20.1011	20.0858	19.8339	19.0943	18.2483	17.5613 (90)
Living area fraction	fLA = Living area / (4) =											0.3186 (91)
MIT	17.9992	18.2719	18.7156	19.3584	19.9073	20.2620	20.3702	20.3521	20.1007	19.4011	18.6127	17.9741 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9992	18.2719	18.7156	19.3584	19.9073	20.2620	20.3702	20.3521	20.1007	19.4011	18.6127	17.9741 (93)

8. Space heating requirement

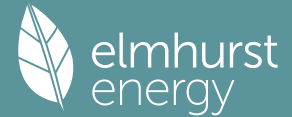
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9839	0.9740	0.9555	0.9063	0.8108	0.6511	0.4911	0.5497	0.7806	0.9303	0.9739	0.9860 (94)
Useful gains	979.7422	1112.9765	1206.0741	1300.7071	1261.9168	1015.5848	729.8060	747.0646	957.6304	996.1573	955.7515	940.6797 (95)
Ext temp.	4.3000	4.9000	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	2882.5580	2805.2978	2555.2014	2157.4004	1688.5962	1150.6611	766.1940	801.3282	1225.3105	1810.7774	2381.2564	2864.7530 (97)
Space heating kWh	1415.6950	1137.2399	1003.7507	616.8191	317.4495	0.0000	0.0000	0.0000	0.0000	606.0773	1026.3635	1431.5106 (98a)
Space heating requirement - total per year (kWh/year)												7554.9055
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	1415.6950	1137.2399	1003.7507	616.8191	317.4495	0.0000	0.0000	0.0000	0.0000	606.0773	1026.3635	1431.5106 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7554.9055
Space heating per m2												(98c) / (4) = 35.0186 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1415.6950	1137.2399	1003.7507	616.8191	317.4495	0.0000	0.0000	0.0000	0.0000	606.0773	1026.3635	1431.5106 (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)	1533.7974	1232.1126	1087.4872	668.2764	343.9322	0.0000	0.0000	0.0000	0.0000	656.6385	1111.9865	1550.9324 (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

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Water heating requirement	279.5953	247.5416	263.8521	234.2584	228.5806	207.6144	206.1785	213.4996	214.8646	237.6020	250.1763	276.8587 (64)
Efficiency of water heater (217)m	87.1784	87.0451	86.7632	86.1264	84.7965	79.8000	79.8000	79.8000	79.8000	86.0663	86.8797	79.8000 (216)
Fuel for water heating, kWh/month	320.7161	284.3831	304.1060	271.9938	269.5637	260.1684	258.3690	267.5433	269.2539	276.0684	287.9571	317.4764 (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	43.8952	35.2144	31.7067	23.2297	17.9433	14.6598	16.3684	21.2763	27.6358	36.2597	40.9552	45.1152 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-52.9022	-75.8682	-110.8476	-126.6482	-138.1390	-129.3412	-127.6148	-119.6555	-105.9500	-87.5526	-58.5678	-45.5773 (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	-26.0693	-55.2502	-110.6306	-167.4070	-222.6508	-224.3285	-221.8240	-187.3306	-136.5733	-79.5745	-34.9747	-20.5945 (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												8185.1631 (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												3387.5992 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												354.2597 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2665.8725 (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												9347.1495 (238)

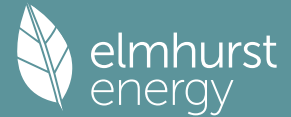
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	8185.1631	0.2100	1718.8842 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3387.5992	0.2100	711.3958 (264)
Space and water heating			2430.2801 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	354.2597	0.1443	51.1306 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1178.6646	0.1343	-158.2602
PV Unit electricity exported	-1487.2079	0.1257	-186.8832
Total			-345.1435 (269)
Total CO2, kg/year			2148.1965 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	8185.1631	1.1300	9249.2343 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3387.5992	1.1300	3827.9871 (278)
Space and water heating			13077.2214 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	354.2597	1.5338	543.3754 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1178.6646	1.4962	-1763.5471
PV Unit electricity exported	-1487.2079	0.4612	-685.9712
Total			-2449.5184 (283)
Total Primary energy kWh/year			11301.1792 (286)
Target Primary Energy Rate (TPER)			52.3800 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 2 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	91 B	DER	1.71	TER	9.96
Environmental	98 A	% DER < TER			82.83
CO ₂ Emissions (t/year)	0.34	DFEE	38.45	TFEE	39.40
Compliance Check	See BREL	% DFEE < TFEE			2.41
% DPER < TPER	66.70	DPER	17.44	TPER	52.38
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	215.7400 (1b)	x 2.7900 (2b)	= 601.9146 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	215.7400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 601.9146 (5)
Dwelling volume			

2. Ventilation rate

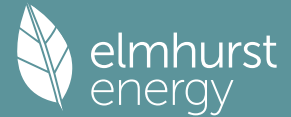
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (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) =	40.0000 / (5) = 0.0665 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.2165 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2165 (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	0.2760	0.2706	0.2652	0.2381	0.2327	0.2056	0.2056	0.2002	0.2165	0.2327	0.2435	0.2543 (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	0.5381	0.5366	0.5352	0.5283	0.5271	0.5211	0.5211	0.5200	0.5234	0.5271	0.5296	0.5323 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			28.6000	1.1450	32.7481		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
UNHEATED SPACE BELOW			24.5600	0.1308	3.2135	110.0000	2701.6000 (28a)
Heatloss Floor 1			108.3700	0.1292	13.9961		(28b)
EXTERNAL	112.5800	28.6000	83.9800	0.1800	15.1164	70.0000	5878.6000 (29a)
HALLWAY	32.1700	2.9100	29.2600	0.1700	4.9742	70.0000	2048.2000 (29a)

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Flat Roof	30.5700	30.5700	0.1100	3.3627	9.0000	275.1300 (30)
Total net area of external elements Aum(A, m2)		308.2500				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	76.9030			(33)
Party Wall 1		37.1900	0.0000	0.0000	180.0000	6694.2000 (32)
Party Floor 1		82.8100			40.0000	3312.4000 (32d)
Party Ceiling 1		185.1700			40.0000	7406.8000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28316.9300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 131.2549 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	16.6200	0.3000	4.9860
E3 Sill	9.3900	0.0400	0.3756
E4 Jamb	37.2800	0.0500	1.8640
E20 Exposed floor (normal)	30.2100	0.3200	9.6672
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.1400	0.0700	0.7098
E14 Flat roof	18.8800	0.0400	0.7552
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.5550 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 98.4580 (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	106.8803	106.5865	106.2986	104.9463	104.6933	103.5154	103.5154	103.2973	103.9691	104.6933	105.2051	105.7402 (38)
Average = Sum(39)m / 12 =	205.3383	205.0445	204.7566	203.4043	203.1512	201.9734	201.9734	201.7553	202.4271	203.1512	203.6631	204.1982 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9518	0.9504	0.9491	0.9428	0.9416	0.9362	0.9362	0.9352	0.9383	0.9416	0.9440	0.9465 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

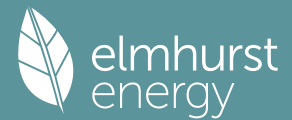
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0224 (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	32.3307	31.8505	31.1744	29.9277	28.9941	27.9590	27.3999	28.0713	28.8024	29.9100	31.1824	32.2214	(42b)
Hot water usage for other uses	45.5823	43.9248	42.2672	40.6097	38.9522	37.2946	37.2946	38.9522	40.6097	42.2672	43.9248	45.5823 (42c)	
Average daily hot water use (litres/day)													71.4141 (43)
Daily hot water use	77.9130	75.7753	73.4416	70.5374	67.9463	65.2536	64.6945	67.0235	69.4121	72.1772	75.1072	77.8037 (44)	
Energy content (annual)	123.3952	107.9030	112.8770	96.5621	91.4688	80.2369	78.2424	82.9890	85.5920	97.9438	107.0039	121.8218 (45)	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	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	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	0.0000 (61)
Total heat required for water heating calculated for each month	104.8859	91.7176	95.9455	82.0778	77.7485	68.2014	66.5060	70.5407	72.7532	83.2522	90.9533	103.5485 (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 (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	104.8859	91.7176	95.9455	82.0778	77.7485	68.2014	66.5060	70.5407	72.7532	83.2522	90.9533	103.5485 (64)	
12Total per year (kWh/year)													1008.1306 (64)
Electric shower(s)	59.9788	53.4416	58.3561	55.6885	56.7335	54.1183	55.9222	56.7335	55.6885	58.3561	57.2588	59.9788 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													682.2548 (64a)
Heat gains from water heating, kWh/month	41.2162	36.2898	38.5754	34.4416	33.6205	30.5799	30.6071	31.8186	32.1104	35.4021	37.0530	40.8818 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.2580	233.8928	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580	218.2999	211.2580	218.2999	211.2580 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	385.7693	389.7724	379.6848	358.2094	331.1006	305.6222	288.6010	284.5979	294.6855	316.1609	343.2697	368.7481 (68)
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)	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956 (71)
Water heating gains (Table 5)	55.3981	54.0027	51.8487	47.8355	45.1888	42.4721	41.1385	42.7669	44.5978	47.5835	51.4626	54.9487 (72)
Total internal gains	720.7612	746.0037	711.1273	692.6807	655.8833	634.7301	609.3334	606.9586	625.9192	643.3382	681.3680	703.2907 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)
West	8.8600	19.6403	0.6300	0.7000	0.7700	53.1806 (80)

Solar gains	142.0556	265.1298	422.7714	621.9698	784.4590	816.9335	771.7708	645.0276	491.0482	309.3498	174.4032	118.7980 (83)
Total gains	862.8168	1011.1335	1133.8987	1314.6505	1440.3423	1451.6636	1381.1042	1251.9863	1116.9674	952.6880	855.7712	822.0887 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, ni1,m (see Table 9a)	38.3066	38.3615	38.4154	38.6708	38.7190	38.9448	38.9448	38.9869	38.8575	38.7190	38.6217	38.5205
tau	3.5538	3.5574	3.5610	3.5781	3.5813	3.5963	3.5963	3.5991	3.5905	3.5813	3.5748	3.5680
util living area	0.9944	0.9896	0.9797	0.9476	0.8736	0.7350	0.5893	0.6539	0.8601	0.9675	0.9903	0.9953 (86)
MIT	18.8288	19.0565	19.4296	19.9708	20.4655	20.8085	20.9366	20.9072	20.6302	19.9910	19.3210	18.7905 (87)
Th 2	20.1237	20.1249	20.1260	20.1313	20.1322	20.1368	20.1368	20.1377	20.1351	20.1322	20.1302	20.1282 (88)
util rest of house	0.9934	0.9877	0.9756	0.9361	0.8439	0.6713	0.4927	0.5595	0.8158	0.9583	0.9881	0.9945 (89)
MIT 2	18.1037	18.3312	18.7029	19.2389	19.7108	20.0148	20.1081	20.0922	19.8718	19.2652	18.5996	18.0686 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.3347	18.5623	18.9344	19.4721	19.9512	20.2676	20.3721	20.3519	20.1134	19.4965	18.8294	18.2986 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.3347	18.5623	18.9344	19.4721	19.9512	20.2676	20.3721	20.3519	20.1134	19.4965	18.8294	18.2986 (93)

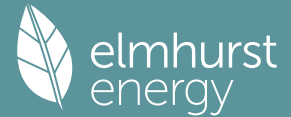
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9903	0.9828	0.9681	0.9253	0.8368	0.6818	0.5205	0.5847	0.8145	0.9496	0.9835	0.9918 (94)
Useful gains	854.4631	993.7492	1097.7054	1216.4911	1205.2484	989.6776	718.8467	732.0487	909.7400	904.6544	841.6470	815.3559 (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	2881.8601	2801.3762	2546.0247	2150.4023	1676.2460	1144.7116	761.8545	797.3085	1217.2767	1807.3254	2388.8542	2878.8991 (97)
Space heating kWh	1508.3834	1214.7254	1077.5495	672.4161	350.4222	0.0000	0.0000	0.0000	0.0000	671.5872	1113.9892	1535.2762 (98a)
Space heating requirement - total per year (kWh/year)	8144.3492											
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	1508.3834	1214.7254	1077.5495	672.4161	350.4222	0.0000	0.0000	0.0000	0.0000	671.5872	1113.9892	1535.2762 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8144.3492											
Space heating per m2	(98c) / (4) = 37.7508 (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	1898.5500	1494.6032	1533.3402	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7081	0.7866	0.7347	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1344.2920	1175.5999	1126.4987	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1588.5708	1510.5335	1364.0343	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	175.8807	249.1906	176.7266	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	43.9702	62.2976	44.1816	0.0000	0.0000	0.0000	0.0000 (107)

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Space cooling requirement	150.4495 (107)
Energy for space heating	37.7508 (99)
Energy for space cooling	0.6974 (108)
Total	38.4481 (109)
Fabric Energy Efficiency (DFEE)	38.4 (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	Storey height	Volume
	(m ²)	(m)	(m ³)
Ground floor	215.7400 (1b)	x 2.7900 (2b)	= 601.9146 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	215.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	601.9146 (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	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0665 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3165 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165 (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 infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718 (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	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
	m ²	m ²	m ²	W/m ² K	W/K	kJ/m ² K	kJ/K
TER Opaque door			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			28.6000	1.1450	32.7481		(27)
UNHEATED SPACE BELOW			24.5600	0.1300	3.1928		(28a)
Heatloss Floor 1			108.3700	0.1300	14.0881		(28b)
EXTERNAL	112.5800	28.6000	83.9800	0.1800	15.1164		(29a)
HALLWAY	32.1700	2.9100	29.2600	0.1800	5.2668		(29a)
Flat Roof	30.5700		30.5700	0.1100	3.3627		(30)
Total net area of external elements Aum(A, m ²)			308.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.6849		(33)
Party Wall 1			37.1900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 131.2549 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	16.6200	0.0500	0.8310
E3 Sill	9.3900	0.0500	0.4695
E4 Jamb	37.2800	0.0500	1.8640
E20 Exposed floor (normal)	30.2100	0.3200	9.6672
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048

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E7 Party floor between dwellings (in blocks of flats)	10.1400	0.0700	0.7098	
E14 Flat roof	18.8800	0.0800	1.5104	
E16 Corner (normal)	16.7400	0.0900	1.5066	
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.9100	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228	
E18 Party wall between dwellings	11.1600	0.0600	0.6696	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				18.2491 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 94.9340 (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	115.4841	114.8563	114.2409	111.3504	110.8096	108.2920	108.2920	107.8258	109.2618	110.8096	111.9036	113.0474 (38)
Heat transfer coeff	210.4181	209.7903	209.1749	206.2844	205.7436	203.2260	203.2260	202.7598	204.1957	205.7436	206.8376	207.9814 (39)
Average = Sum(39)m / 12 =												206.2818

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9753	0.9724	0.9696	0.9562	0.9537	0.9420	0.9420	0.9398	0.9465	0.9537	0.9587	0.9640 (40)
HLP (average)												0.9562
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

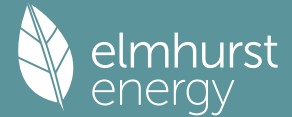
Assumed occupancy													3.0224 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.3307	31.8505	31.1744	29.9277	28.9941	27.9590	27.3999	28.0713	28.8024	29.9100	31.1824	32.2214	(42b)
Hot water usage for other uses	45.5823	43.9248	42.2672	40.6097	38.9522	37.2946	37.2946	38.9522	40.6097	42.2672	43.9248	45.5823	(42c)
Average daily hot water use (litres/day)													71.4141 (43)
Daily hot water use	77.9130	75.7753	73.4416	70.5374	67.9463	65.2536	64.6945	67.0235	69.4121	72.1772	75.1072	77.8037	(44)
Energy conte	123.3952	107.9030	112.8770	96.5621	91.4688	80.2369	78.2424	82.9890	85.5920	97.9438	107.0039	121.8218	(45)
Energy content (annual)													Total = Sum(45)m = 1186.0360
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	104.8859	91.7176	95.9455	82.0778	77.7485	68.2014	66.5060	70.5407	72.7532	83.2522	90.9533	103.5485	(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	104.8859	91.7176	95.9455	82.0778	77.7485	68.2014	66.5060	70.5407	72.7532	83.2522	90.9533	103.5485	(64)
													Total per year (kWh/year) = Sum(64)m = 1008.1306 (64)
12Total per year (kWh/year)													1008 (64)
Electric shower(s)	59.9788	53.4416	58.3561	55.6885	56.7335	54.1183	55.9222	56.7335	55.6885	58.3561	57.2588	59.9788	(64a)
													Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 682.2548 (64a)
Heat gains from water heating, kWh/month	41.2162	36.2898	38.5754	34.4416	33.6205	30.5799	30.6071	31.8186	32.1104	35.4021	37.0530	40.8818	(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	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195	151.1195 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.2580	233.8928	211.2580	218.2999	211.2580	218.2999	211.2580	211.2580	218.2999	211.2580	218.2999	211.2580 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	385.7693	389.7724	379.6848	358.2094	331.1006	305.6222	288.6010	284.5979	294.6855	316.1609	343.2697	368.7481 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120	38.1120 (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)	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956	-120.8956 (71)
Water heating gains (Table 5)	55.3981	54.0027	51.8487	47.8355	45.1888	42.4721	41.1385	42.7669	44.5978	47.5835	51.4626	54.9487 (72)
Total internal gains	720.7612	746.0037	711.1273	692.6807	655.8833	634.7301	609.3334	606.9586	625.9192	643.3382	681.3680	703.2907 (73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)
West	8.8600	19.6403	0.6300	0.7000	0.7700	53.1806 (80)

Solar gains	142.0556	265.1298	422.7714	621.9698	784.4590	816.9335	771.7708	645.0276	491.0482	309.3498	174.4032	118.7980 (83)
Total gains	862.8168	1011.1335	1133.8987	1314.6505	1440.3423	1451.6636	1381.1042	1251.9863	1116.9674	952.6880	855.7712	822.0887 (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, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.3818	37.4937	37.6040	38.1309	38.2312	38.7048	38.7048	38.7938	38.5209	38.2312	38.0289	37.8198
alpha	3.4921	3.4996	3.5069	3.5421	3.5487	3.5803	3.5803	3.5863	3.5681	3.5487	3.5353	3.5213
util living area	0.9944	0.9897	0.9799	0.9483	0.8756	0.7369	0.5917	0.6557	0.8616	0.9678	0.9903	0.9953 (86)
MIT	18.7734	19.0055	19.3859	19.9465	20.4495	20.8044	20.9348	20.9053	20.6223	19.9723	19.2915	18.7489 (87)
Th 2	20.1039	20.1064	20.1088	20.1200	20.1221	20.1320	20.1320	20.1338	20.1282	20.1221	20.1179	20.1134 (88)
util rest of house	0.9933	0.9877	0.9758	0.9369	0.8460	0.6730	0.4945	0.5610	0.8174	0.9587	0.9881	0.9944 (89)
MIT 2	18.0346	18.2675	18.6473	19.2069	19.6881	20.0073	20.1024	20.0874	19.8592	19.2395	18.5615	18.0168 (90)
Living area fraction									flA = Living area / (4) =			
MIT	18.2700	18.5026	18.8826	19.4425	19.9307	20.2612	20.3676	20.3480	20.1023	19.4730	18.7941	18.2501 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2700	18.5026	18.8826	19.4425	19.9307	20.2612	20.3676	20.3480	20.1023	19.4730	18.7941	18.2501 (93)

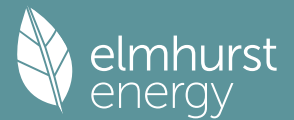
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9902	0.9827	0.9682	0.9260	0.8385	0.6834	0.5224	0.5862	0.8158	0.9498	0.9834	0.9917 (94)
Useful gains	854.3500	993.6750	1097.8406	1217.3281	1207.7723	992.0630	721.4229	733.8743	911.2487	904.8985	841.6002	815.2752 (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	2939.5312	2853.7020	2590.1310	2174.7507	1693.4041	1150.5064	765.6757	800.4893	1225.6457	1825.5530	2418.7694	2922.1489 (97)
Space heating kWh	1551.3749	1249.9382	1110.2640	689.3443	361.3101	0.0000	0.0000	0.0000	0.0000	684.9670	1135.5618	1567.5140 (98a)
Space heating requirement - total per year (kWh/year)												8350.2742
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	1551.3749	1249.9382	1110.2640	689.3443	361.3101	0.0000	0.0000	0.0000	0.0000	684.9670	1135.5618	1567.5140 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8350.2742
Space heating per m2												(98c) / (4) = 38.7053 (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	1910.3246	1503.8726	1540.9746	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7047	0.7834	0.7320	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1346.1916	1178.1315	1127.9827	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1588.5708	1510.5335	1364.0343	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	174.5130	247.3071	175.6225	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	43.6283	61.8268	43.9056	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												149.3606 (107)
Energy for space heating												38.7053 (99)
Energy for space cooling												0.6923 (108)
Total												39.3976 (109)
Fabric Energy Efficiency (TFEE)												39.4 (109)

Predicted Energy Assessment

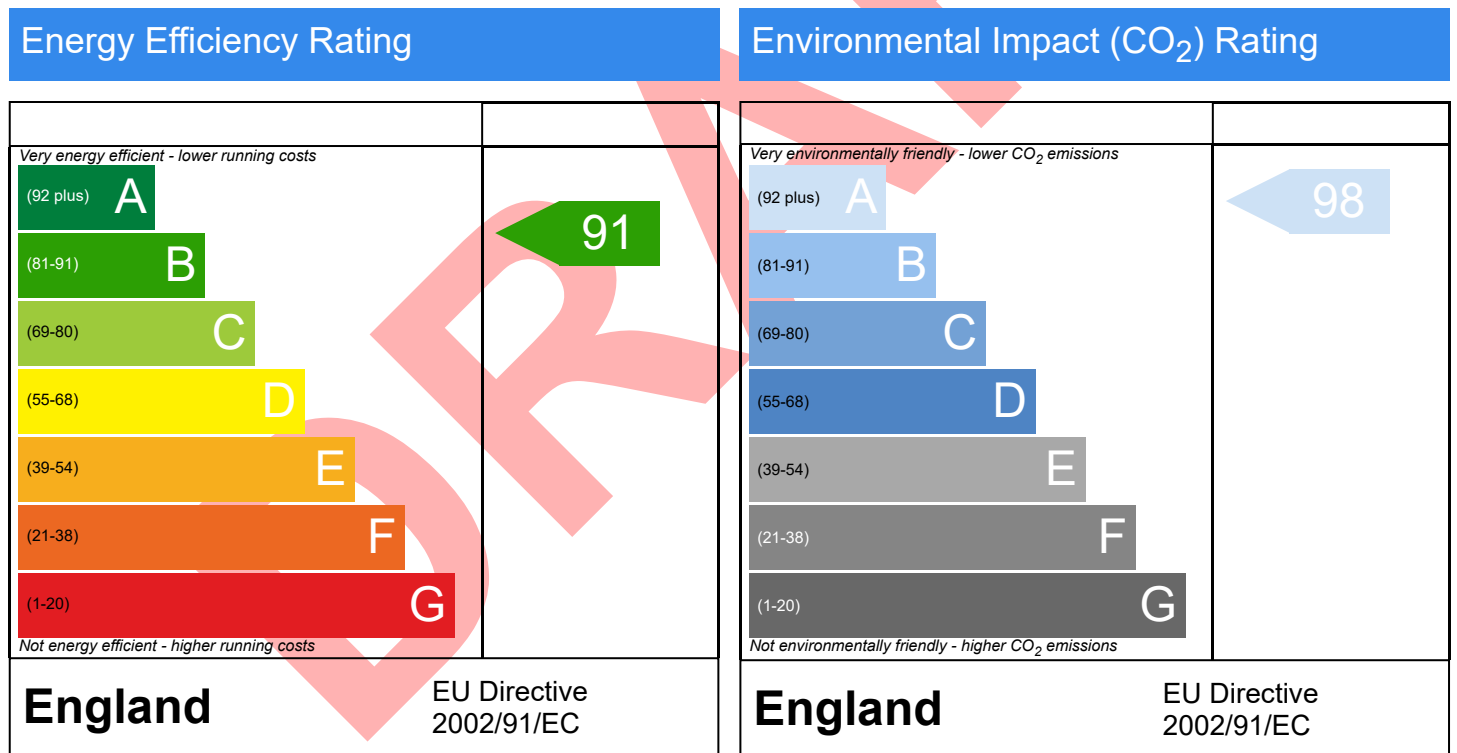


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Semi-Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 215.74 m²
 DRRN:

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.

Overview Report

Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Semi-Detached
Floor Area [m ²]	216

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

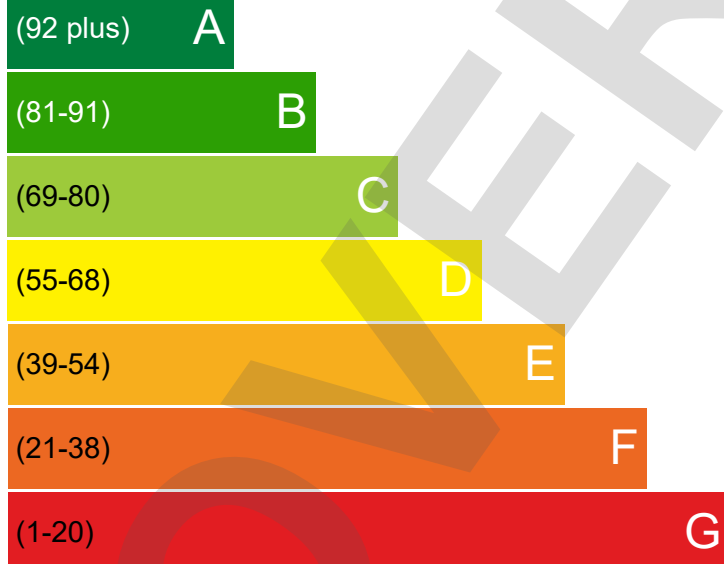
Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL



91

91

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.13 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 16 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.3** per year

With the recommended measures the potential CO emissions could be: **0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£477

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:03

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Semi-detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	214 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 3 - Boiler
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	10.22 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	13.21 kgCO ₂ /m ²	FAIL
1b Target primary energy rate and dwelling primary energy		
Target primary energy	53.82 kWh _{PE} /m ²	
Dwelling primary energy	73.22 kWh _{PE} /m ²	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	40.5 kWh/m ²	
Dwelling fabric energy efficiency	39.5 kWh/m ²	OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.14	Heatloss Floor 1 (0.14)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	EAST (1.2)	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)	96.13	0.18
Sheltered wall: Walls (2)	37.41	0.18
Party wall: Party Wall (1)	37.19	0 (!)
Upper floor: Heatloss Floor 1, Heatloss Floor 1	132.72	0.14
Exposed roof: Roof (1)	30.59	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
EAST, Windows	7.53	East	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	West	N/A	1.2
SOUTH, Windows	2.24	South	0.7	1.2
NORTH, Windows	17.5	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.32	
External wall	E21: Exposed floor (inverted)	Calculated by person with suitable expertise	0.32	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

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		3 m ³ /hm ² , Design value (!)		OK
Air permeability test certificate reference				

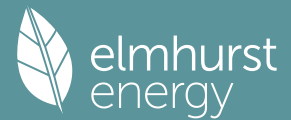
4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	84.2%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Regular boiler
Manufacturer	Vaillant
Model	ecoFIT pure 630
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	500 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 3 - Boiler	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	85 B	DER	13.21	TER	10.22
Environmental	86 B	% DER < TER			-29.26
CO ₂ Emissions (t/year)	2.67	DFEE	39.45	TFEE	40.47
Compliance Check	See BREL	% DFEE < TFEE			2.52
% DPER < TPER	-36.05	DPER	73.22	TPER	53.82

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
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	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	213.50 m ²	2.79 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	68.10	m ²
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9.0 External Walls	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
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	123.40	96.13	0.00	None	27.27	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	40.32	37.41	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	37.19	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	30.59	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	182.91

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Exposed Floor - Solid	Lowest occupied	Other	0.14	Garage Double 1 Inside	0.60	0.00	132.72
UNHEATED SPACE BELOW	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.14	Stairwell Access Corridor 1	0.50	110.00	1.85

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	78.93

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
EAST	Windows	EXTERNAL	East	7.53	0
ENTRANCE DOOR	Entrance Door	HALLWAY	West	2.91	0
SOUTH	Windows	EXTERNAL	South	2.24	0
NORTH	Windows	EXTERNAL	North	17.50	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	15.67	0.30	0.30	No
E3 Sill	Independently assessed	8.44	0.04	0.04	No
E4 Jamb	Independently assessed	34.48	0.05	0.05	No
E20 Exposed floor (normal)	Independently assessed	33.79	0.32	0.32	No
E21 Exposed floor (inverted)	Independently assessed	6.89	0.32	0.32	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	10.44	0.07	0.07	No
E14 Flat roof	Independently assessed	18.92	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.74	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	16.74	-0.09	-0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	28.64	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	2.69	0.12	0.12	No
E18 Party wall between dwellings	Independently assessed	11.16	0.06	0.06	No

Y-value W/m²K

18.0 Pressure Testing

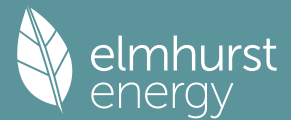
Designed AP ₅₀	<input type="text" value="3.00"/>	m³/(h.m²) @ 50 Pa
Property Tested?	<input type="text" value="Yes"/>	
Test Method	<input type="text" value="Blower Door"/>	
As Built AP ₅₀	<input type="text" value="0.10"/>	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	<input type="text" value="Yes"/>
Approved Installation	<input type="text" value="No"/>
Mechanical Ventilation data Type	<input type="text" value="Database"/>
Type	<input type="text" value="Mechanical extract ventilation - centralised"/>
MV Reference Number	<input type="text" value="500808"/>
Configuration	<input type="text" value="4"/>
Manufacturer SFP	<input type="text" value="0.18"/>
Duct Type	<input type="text" value="Rigid"/>

Summary for Input Data



MVHR Efficiency	0.00
Wet Rooms	4
SFP from Installer Commissioning Certificate	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Database	<input type="text" value="Database"/>
Percentage of Heat	<input type="text" value="100.00"/> %
Database Ref. No.	<input type="text" value="17972"/>
Fuel Type	<input type="text" value="Mains gas"/>
SAP Code	<input type="text" value="0"/>
In Winter	<input type="text" value="89.20"/>
In Summer	<input type="text" value="80.20"/>
Model Name	<input type="text" value="ecoFIT pure 630"/>
Manufacturer	<input type="text" value="Vaillant"/>
System Type	<input type="text" value="Regular boiler"/>
Controls SAP Code	<input type="text" value="2110"/>
Delayed Start Stat	<input type="text" value="No"/>
Burner Control	<input type="text" value="Modulating"/>
HETAS approved System	<input type="text" value="No"/>
Oil Pump Inside	<input type="text" value="No"/>
FI Case	<input type="text" value="0.00"/>
Flue Type	<input type="text" value="Balanced"/>
Fan Assisted Flue	<input type="text" value="Yes"/>
Is MHS Pumped	<input type="text" value="Pump in heated space"/>
Heating Pump Age	<input type="text" value="2013 or later"/>
Heat Emitter	<input type="text" value="Radiators and Underfloor"/>
Underfloor Heating	<input type="text" value="Yes - Pipes in thin screed"/>
Flow Temperature	<input type="text" value="Unknown"/>
Boiler Interlock	<input type="text" value="No"/>
Combi boiler type	<input type="text" value="No Combi"/>
Combi keep hot type	<input type="text" value="None"/>

25.0 Main Heating 2

26.0 Heat Networks

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating	<input type="text" value="Main Heating 1"/>
SAP Code	<input type="text" value="901"/>
Flue Gas Heat Recovery System	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 1	<input type="text" value="No"/>
Waste Water Heat Recovery Instantaneous System 2	<input type="text" value="No"/>

Summary for Input Data

Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No
Summer Immersion	No
Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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
Independent Time Control	Yes
Insulation Type	Foam
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

Thermal Store	None
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Recommendations

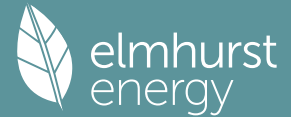
Lower cost measures

None

Further measures to achieve even higher standards

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

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 3 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	85 B	DER	13.21	TER	10.22
Environmental	86 B	% DER < TER			-29.26
CO ₂ Emissions (t/year)	2.67	DFEE	39.45	TFEE	40.47
Compliance Check	See BREL	% DFEE < TFEE			2.52
% DPER < TPER	-36.05	DPER	73.22	TPER	53.82
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	213.5000 (1b)	2.7900 (2b)	595.6650 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	213.5000		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 595.6650 (5)

2. Ventilation rate

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

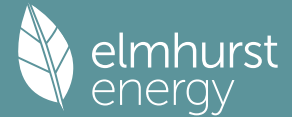
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			27.2700	1.1450	31.2252		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
UNHEATED SPACE BELOW			1.8500	0.1308	0.2421	110.0000	203.5000 (28a)
Heatloss Floor 1			132.7200	0.1292	17.1410		(28b)

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EXTERNAL	123.4000	27.2700	96.1300	0.1800	17.3034	70.0000	6729.1000 (29a)
HALLWAY	40.3200	2.9100	37.4100	0.1700	6.3597	70.0000	2618.7000 (29a)
Flat Roof	30.5900		30.5900	0.1100	3.3649	9.0000	275.3100 (30)
Total net area of external elements Aum(A, m2)			328.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	79.1282			(33)
Party Wall 1			37.1900	0.0000	0.0000	180.0000	6694.2000 (32)
Party Floor 1			78.9300			40.0000	3157.2000 (32d)
Party Ceiling 1			182.9100			30.0000	5487.3000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25165.3100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 117.8703 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.6700	0.3000	4.7010
E3 Sill	8.4400	0.0400	0.3376
E4 Jamb	34.4800	0.0500	1.7240
E20 Exposed floor (normal)	33.7900	0.3200	10.8128
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.4400	0.0700	0.7308
E14 Flat roof	18.9200	0.0400	0.7568
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.2602 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 101.3884 (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	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847 (38)
Average = Sum(39)m / 12 =	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

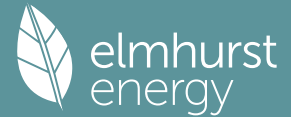
4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0195 (42)

Hot water usage for mixer showers	74.8466	73.7218	72.0827	68.9467	66.6324	64.0515	62.5845	64.2112	65.9943	68.7654	71.9688	74.5598 (42a)
Hot water usage for baths	34.0102	33.5051	32.7938	31.4823	30.5003	29.4114	28.8232	29.5296	30.2986	31.4638	32.8023	33.8952 (42b)
Hot water usage for other uses	47.9500	46.2063	44.4627	42.7191	40.9754	39.2318	39.2318	40.9754	42.7191	44.4627	46.2063	47.9500 (42c)
Average daily hot water use (litres/day)												144.1298 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	156.8068	153.4333	149.3393	143.1481	138.1082	132.6947	130.6396	134.7162	139.0119	144.6918	150.9774	156.4050 (44)
Energy content (annual)	248.3436	218.4869	229.5289	195.9626	185.9201	163.1636	157.9972	166.8067	171.4156	196.3455	215.0949	244.8925 (45)
Distribution loss (46)m = 0.15 x (45)m	37.2515	32.7730	34.4293	29.3944	27.8880	24.4745	23.6996	25.0210	25.7123	29.4518	32.2642	36.7339 (46)
Water storage loss:												
Store volume												500.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115 (51)
Volume factor from Table 2a												0.6214 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												1.9376 (55)
Total storage loss	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650 (56)
If cylinder contains dedicated solar storage	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650 (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	331.6710	293.7504	312.8563	276.6021	269.2476	243.8031	241.3246	250.1342	252.0551	279.6729	295.7344	328.2199 (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 (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	331.6710	293.7504	312.8563	276.6021	269.2476	243.8031	241.3246	250.1342	252.0551	279.6729	295.7344	328.2199 (64)
12Total per year (kWh/year)												3375.0715 (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	149.2362	132.8577	142.9803	129.6691	128.4804	118.7635	119.1960	122.1252	121.5072	131.9468	136.0306	148.0887 (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	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.8623	234.5619	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623	218.9244	211.8623	218.9244	211.8623
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	383.7015	387.6832	377.6496	356.2893	329.3259	303.9840	287.0541	283.0724	293.1060	314.4662	341.4297	366.7716
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974
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
Losses e.g. evaporation (negative values) (Table 5)	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791
Water heating gains (Table 5)	200.5863	197.7049	192.1778	180.0960	172.6887	164.9493	160.2097	164.1467	168.7601	177.3479	188.9314	199.0439
Total internal gains	867.4423	891.2421	852.9819	826.6020	785.1691	756.1498	727.4183	727.3737	749.0827	774.9686	820.5777	848.9701

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)						
East	7.5300	19.6403	0.6300	0.7000	0.7700	45.1975 (76)						
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)						
Solar gains	134.0725	249.5132	397.0531	584.4611	738.4907	769.8769	726.9709	606.5452	461.1367	290.8194	164.4492	112.2331
Total gains	1001.5148	1140.7553	1250.0350	1411.0631	1523.6598	1526.0267	1454.3892	1333.9189	1210.2194	1065.7880	985.0270	961.2032

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 _{1,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090
alpha	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339
util living area	0.9872	0.9794	0.9645	0.9233	0.8388	0.6970	0.5539	0.6115	0.8164	0.9442	0.9794	0.9889
MIT	19.2811	19.4533	19.7361	20.1358	20.5063	20.7591	20.8571	20.8364	20.6375	20.1656	19.6521	19.2407
Th 2	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377
util rest of house	0.9851	0.9759	0.9582	0.9087	0.8063	0.6340	0.4622	0.5208	0.7678	0.9308	0.9753	0.9870
MIT 2	18.0833	18.3026	18.6621	19.1636	19.6133	19.8962	19.9888	19.9733	19.7733	19.2074	18.5577	18.0318
Living area fraction	f _{LA} = Living area / (4) =											
MIT	18.4653	18.6696	19.0047	19.4737	19.8981	20.1714	20.2657	20.2486	20.0489	19.5130	18.9068	18.4174
Temperature adjustment	0.0000											
adjusted MIT	18.4653	18.6696	19.0047	19.4737	19.8981	20.1714	20.2657	20.2486	20.0489	19.5130	18.9068	18.4174

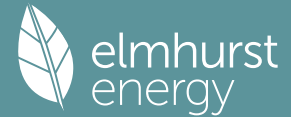
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9795	0.9681	0.9477	0.8952	0.7960	0.6367	0.4766	0.5333	0.7620	0.9186	0.9675	0.9820
Useful gains	980.9820	1104.4147	1184.6016	1263.1424	1212.8934	971.5576	693.1199	711.4288	922.2272	979.0114	953.0428	943.8554
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	2828.4384	2749.4224	2496.8439	2111.2832	1636.9414	1112.4643	731.9492	768.4614	1187.8427	1779.6951	2357.4935	2838.8386
Space heating kWh	1374.5076	1105.4451	976.3083	610.6614	315.4917	0.0000	0.0000	0.0000	0.0000	595.7087	1011.2044	1409.8676
Space heating requirement - total per year (kWh/year)												7399.1948
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1374.5076	1105.4451	976.3083	610.6614	315.4917	0.0000	0.0000	0.0000	0.0000	595.7087	1011.2044	1409.8676
Space heating requirement after solar contribution - total per year (kWh/year)												7399.1948
Space heating per m ²												(98c) / (4) = 34.6567 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												84.2000 (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

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Space heating requirement	1374.5076	1105.4451	976.3083	610.6614	315.4917	0.0000	0.0000	0.0000	0.0000	595.7087	1011.2044	1409.8676	(98)
Space heating efficiency (main heating system 1)	84.2000	84.2000	84.2000	84.2000	84.2000	0.0000	0.0000	0.0000	0.0000	84.2000	84.2000	84.2000	(210)
Space heating fuel (main heating system)	1632.4318	1312.8802	1159.5110	725.2510	374.6933	0.0000	0.0000	0.0000	0.0000	707.4925	1200.9554	1674.4270	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	331.6710	293.7504	312.8563	276.6021	269.2476	243.8031	241.3246	250.1342	252.0551	279.6729	295.7344	328.2199	(64)
Efficiency of water heater (217)m	82.2957	82.1469	81.8352	81.1849	79.8173	75.2000	75.2000	75.2000	75.2000	81.1126	81.9910	82.3489	(216)
Fuel for water heating, kWh/month	403.0237	357.5918	382.3006	340.7063	337.3298	324.2062	320.9104	332.6252	335.1796	344.7957	360.6911	398.5721	(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 (235c)m	22.8577	20.6457	22.8577	22.1204	22.8577	22.1204	22.8577	22.1204	22.8577	22.1204	22.8577	22.1204	(231)
Lighting (233b)m	40.9616	32.8609	29.5876	21.6772	16.7441	13.6800	15.2745	19.8544	25.7889	33.8364	38.2181	42.1001	(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												8787.6423	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.2000	
Water heating fuel used												4237.9326	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)													
mechanical ventilation fans (SFP = 0.2520)												183.1312	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												269.1312	(231)
Electricity for lighting (calculated in Appendix L)												330.5837	(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												13625.2898	(238)

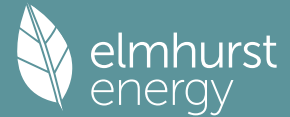
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	8787.6423	0.2100	1845.4049 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	4237.9326	0.2100	889.9659 (264)
Space and water heating			2735.3707 (265)
Pumps, fans and electric keep-hot	269.1312	0.1387	37.3318 (267)
Energy for lighting	330.5837	0.1443	47.7134 (268)
Total CO2, kg/year			2820.4160 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.2100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	8787.6423	1.1300	9930.0358 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4237.9326	1.1300	4788.8639 (278)
Space and water heating			14718.8996 (279)
Pumps, fans and electric keep-hot	269.1312	1.5128	407.1418 (281)
Energy for lighting	330.5837	1.5338	507.0603 (282)

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Total Primary energy kWh/year
Dwelling Primary energy Rate (DPER)

15633.1017 (286)
73.2200 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	213.5000 (1b)	x 2.7900 (2b)	= 595.6650 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	213.5000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	595.6650 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0672 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3172 (18)	
Number of sides sheltered	0 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3172 (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												
Effective ac	0.4044	0.3964	0.3885	0.3489	0.3409	0.3013	0.3013	0.2934	0.3172	0.3409	0.3568	0.3727 (22b)
	0.5818	0.5786	0.5755	0.5609	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5637	0.5694 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			27.2700	1.1450	31.2252		(27)
UNHEATED SPACE BELOW			1.8500	0.1300	0.2405		(28a)
Heatloss Floor 1			132.7200	0.1300	17.2536		(28b)
EXTERNAL	123.4000	27.2700	96.1300	0.1800	17.3034		(29a)
HALLWAY	40.3200	2.9100	37.4100	0.1800	6.7338		(29a)
Flat Roof	30.5900		30.5900	0.1100	3.3649		(30)
Total net area of external elements Aum(A, m ²)			328.8800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.0314		(33)
Party Wall 1			37.1900	0.0000	0.0000		(32)

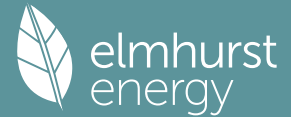
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

126.4375 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.6700	0.0500	0.7835
E3 Sill	8.4400	0.0500	0.4220
E4 Jamb	34.4800	0.0500	1.7240
E20 Exposed floor (normal)	33.7900	0.3200	10.8128
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.4400	0.0700	0.7308
E14 Flat roof	18.9200	0.0800	1.5136
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6400	0.0000	0.0000

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P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228	
E18 Party wall between dwellings	11.1600	0.0600	0.6696	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				19.1839 (36)
Point Thermal bridges				0.0000 (36a) =
Total fabric heat loss				98.2153 (37) (33) + (36) + (36a) =

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	114.3556	113.7316	113.1199	110.2468	109.7092	107.2068	107.2068	106.7434	108.1707	109.7092	110.7967	111.9336 (38)
Average = Sum(39)m / 12 =	212.5709	211.9469	211.3352	208.4621	207.9245	205.4221	205.4221	204.9587	206.3860	207.9245	209.0120	210.1489 (39)
												208.4595
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9956	0.9927	0.9899	0.9764	0.9739	0.9622	0.9622	0.9600	0.9667	0.9739	0.9790	0.9843 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

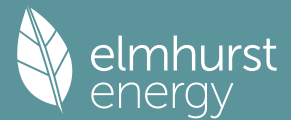
Assumed occupancy													3.0195 (42)
Hot water usage for mixer showers	74.8466	73.7218	72.0827	68.9467	66.6324	64.0515	62.5845	64.2112	65.9943	68.7654	71.9688	74.5598	74.5598 (42a)
Hot water usage for baths	32.3097	31.8299	31.1541	29.9082	28.9753	27.9408	27.3821	28.0531	28.7837	29.8906	31.1621	32.2005	32.2005 (42b)
Hot water usage for other uses	45.5525	43.8960	42.2396	40.5831	38.9267	37.2702	37.2702	38.9267	40.5831	42.2396	43.8960	45.5525	45.5525 (42c)
Average daily hot water use (litres/day)													140.3736 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	152.7088	149.4477	145.4764	139.4381	134.5344	129.2626	127.2368	131.1909	135.3611	140.8955	147.0269	152.3128	152.3128 (44)
Energy content (annual)	241.8534	212.8115	223.5919	190.8837	181.1091	158.9434	153.8819	162.4417	166.9137	191.1939	209.4668	238.4850	238.4850 (45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2331.5761
Water storage loss:	36.2780	31.9217	33.5388	28.6326	27.1664	23.8415	23.0823	24.3663	25.0371	28.6791	31.4200	35.7728	35.7728 (46)
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.9009 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.5665 (55)
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607 (56)
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607 (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	313.6765	277.6840	295.4150	260.3900	252.9322	228.4496	225.7050	234.2649	236.4200	263.0170	278.9731	310.3081	310.3081 (62)
MWHR	-34.2167	-30.2616	-31.6882	-26.2391	-24.4539	-20.9253	-19.6142	-20.8577	-21.6502	-25.5232	-28.9146	-33.5831	-33.5831 (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)
FGHR	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	279.4597	247.4224	263.7268	234.1509	228.4784	207.5243	206.0908	213.4072	214.7698	237.4939	250.0584	276.7250	276.7250 (64)
Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2859.3077 (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	137.8747	122.6578	131.8028	119.0738	117.6773	108.4537	108.6242	111.4704	111.1038	121.0305	125.2527	136.7548	136.7548 (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	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	211.8623	234.5619	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	383.7015	387.6832	377.6496	356.2893	329.3259	303.9840	287.0541	283.0724	293.1060	314.4662	341.4297	366.7716	366.7716 (68)
Pumps, fans	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791 (71)
Total internal gains	185.3155	182.5265	177.1543	165.3803	158.1684	150.6301	146.0003	149.8258	154.3108	162.6753	173.9621	183.8102	183.8102 (72)
	852.1716	876.0637	837.9584	811.8863	770.6488	741.8307	713.2089	713.0527	734.6334	760.2961	805.6084	833.7363	833.7363 (73)

6. Solar gains

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[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North		17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
East		7.5300	19.6403	0.6300	0.7000	0.7700	45.1975 (76)
South		2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)

Solar gains	134.0725	249.5132	397.0531	584.4611	738.4907	769.8769	726.9709	606.5452	461.1367	290.8194	164.4492	112.2331 (83)
Total gains	986.2440	1125.5769	1235.0115	1396.3474	1509.1395	1511.7075	1440.1798	1319.5979	1195.7701	1051.1155	970.0577	945.9694 (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	35.2750	35.3789	35.4813	35.9703	36.0633	36.5026	36.5026	36.5852	36.3321	36.0633	35.8757	35.6816
alpha	3.3517	3.3586	3.3654	3.3980	3.4042	3.4335	3.4335	3.4390	3.4221	3.4042	3.3917	3.3788
util living area	0.9901	0.9837	0.9714	0.9354	0.8579	0.7176	0.5735	0.6317	0.8362	0.9540	0.9837	0.9914 (86)
MIT	18.7767	19.0067	19.3861	19.9428	20.4441	20.7993	20.9320	20.9045	20.6302	19.9912	19.3056	18.7521 (87)
Th 2	20.0870	20.0894	20.0918	20.1030	20.1052	20.1150	20.1150	20.1168	20.1112	20.1052	20.1009	20.0964 (88)
util rest of house	0.9883	0.9807	0.9659	0.9218	0.8260	0.6528	0.4769	0.5369	0.7879	0.9418	0.9802	0.9899 (89)
MIT 2	17.4472	17.7420	18.2264	18.9339	19.5458	19.9513	20.0754	20.0570	19.7773	19.0041	18.1323	17.4216 (90)
Living area fraction									fLA = Living area / (4) =			0.3190 (91)
MIT	17.8713	18.1454	18.5963	19.2557	19.8324	20.2218	20.3487	20.3273	20.0493	19.3190	18.5066	17.8460 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8713	18.1454	18.5963	19.2557	19.8324	20.2218	20.3487	20.3273	20.0493	19.3190	18.5066	17.8460 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9818	0.9717	0.9534	0.9058	0.8147	0.6613	0.5038	0.5611	0.7840	0.9277	0.9714	0.9841 (94)
Useful gains	968.2952	1093.6674	1177.4311	1264.7729	1229.5694	999.6629	725.5285	740.3961	937.4831	975.1653	942.2715	930.9024 (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	2884.8556	2807.3271	2556.3801	2158.7755	1690.9184	1154.8394	770.0587	804.9437	1227.8561	1812.8914	2384.1062	2867.6858 (97)
Space heating kWh	1425.9210	1151.5794	1025.9381	643.6818	343.2437	0.0000	0.0000	0.0000	0.0000	623.2683	1038.1210	1440.9668 (98a)
Space heating requirement - total per year (kWh/year)												7692.7200
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	1425.9210	1151.5794	1025.9381	643.6818	343.2437	0.0000	0.0000	0.0000	0.0000	623.2683	1038.1210	1440.9668 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7692.7200
Space heating per m2										(98c) / (4) =		36.0315 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1425.9210	1151.5794	1025.9381	643.6818	343.2437	0.0000	0.0000	0.0000	0.0000	623.2683	1038.1210	1440.9668 (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)	1544.8764	1247.6483	1111.5255	697.3801	371.8783	0.0000	0.0000	0.0000	0.0000	675.2635	1124.7248	1561.1775 (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	279.4597	247.4224	263.7268	234.1509	228.4784	207.5243	206.0908	213.4072	214.7698	237.4939	250.0584	276.7250 (64)
Efficiency of water heater (217)m	87.1886	87.0634	86.7982	86.2066	84.9703	79.8000	79.8000	79.8000	79.8000	86.1201	86.8976	79.8000 (216)
Fuel for water heating, kWh/month	320.5232	284.1865	303.8392	271.6159	268.8921	260.0555	258.2592	267.4275	269.1351	275.7704	287.7623	317.2894 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	44.0208	35.3151	31.7974	23.2961	17.9946	14.7017	16.4153	21.3372	27.7149	36.3634	41.0724	45.2443 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233a)m	-52.4178	-75.2059	-109.9250	-125.6463	-137.0903	-128.3762	-126.6672	-118.7504	-105.1175	-86.8184	-58.0448	-45.1566	(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	-25.7337	-54.5511	-109.2536	-165.3558	-219.9535	-221.6214	-219.1435	-185.0484	-134.8877	-78.5735	-34.5265	-20.3281	(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												8334.4745	(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												3384.7562	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.2731	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2638.1931	(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												9522.3108	(238)

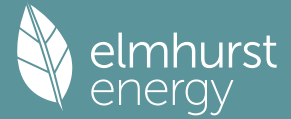
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	8334.4745	0.2100	1750.2396 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3384.7562	0.2100	710.7988 (264)
Space and water heating			2461.0385 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	355.2731	0.1443	51.2769 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1169.2164	0.1343	-156.9811
PV Unit electricity exported	-1468.9767	0.1257	-184.5843
Total			-341.5654 (269)
Total CO2, kg/year			2182.6792 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.2200 (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	8334.4745	1.1300	9417.9562 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3384.7562	1.1300	3824.7746 (278)
Space and water heating			13242.7307 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	355.2731	1.5338	544.9298 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1169.2164	1.4962	-1749.3711
PV Unit electricity exported	-1468.9767	0.4612	-677.5324
Total			-2426.9035 (283)
Total Primary energy kWh/year			11490.8579 (286)
Target Primary Energy Rate (TPER)			53.8200 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 3 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	85 B	DER	13.21	TER	10.22
Environmental	86 B	% DER < TER			-29.26
CO ₂ Emissions (t/year)	2.67	DFEE	39.45	TFEE	40.47
Compliance Check	See BREL	% DFEE < TFEE			2.52
% DPER < TPER	-36.05	DPER	73.22	TPER	53.82
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	213.5000 (1b)	2.7900 (2b)	595.6650 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	213.5000		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 595.6650 (5)

2. Ventilation rate

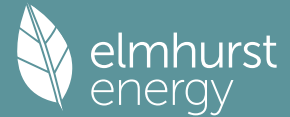
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (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) =	40.0000 / (5) = 0.0672 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.2172 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2172 (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	0.2769	0.2714	0.2660	0.2389	0.2334	0.2063	0.2063	0.2009	0.2172	0.2334	0.2443	0.2552 (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	0.5383	0.5368	0.5354	0.5285	0.5272	0.5213	0.5213	0.5202	0.5236	0.5272	0.5298	0.5326 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			27.2700	1.1450	31.2252		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
UNHEATED SPACE BELOW			1.8500	0.1308	0.2421	110.0000	203.5000 (28a)
Heatloss Floor 1			132.7200	0.1292	17.1410		(28b)
EXTERNAL	123.4000	27.2700	96.1300	0.1800	17.3034	70.0000	6729.1000 (29a)
HALLWAY	40.3200	2.9100	37.4100	0.1700	6.3597	70.0000	2618.7000 (29a)

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Flat Roof	30.5900	30.5900	0.1100	3.3649	9.0000	275.3100 (30)
Total net area of external elements Aum(A, m2)		328.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	79.1282		(33)
Party Wall 1		37.1900	0.0000	0.0000	180.0000	6694.2000 (32)
Party Floor 1		78.9300			40.0000	3157.2000 (32d)
Party Ceiling 1		182.9100			40.0000	7316.4000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 26994.4100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 126.4375 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.6700	0.3000	4.7010
E3 Sill	8.4400	0.0400	0.3376
E4 Jamb	34.4800	0.0500	1.7240
E20 Exposed floor (normal)	33.7900	0.3200	10.8128
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.4400	0.0700	0.7308
E14 Flat roof	18.9200	0.0400	0.7568
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.2602 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 101.3884 (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	105.8189	105.5263	105.2395	103.8926	103.6406	102.4675	102.4675	102.2502	102.9193	103.6406	104.1504	104.6834 (38)
Heat transfer coeff	207.2073	206.9147	206.6279	205.2810	205.0290	203.8559	203.8559	203.6386	204.3077	205.0290	205.5388	206.0718 (39)
Average = Sum(39)m / 12 =												205.2798

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9705	0.9692	0.9678	0.9615	0.9603	0.9548	0.9548	0.9538	0.9569	0.9603	0.9627	0.9652 (40)
HLP (average)												0.9615
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0195 (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	32.3097	31.8299	31.1541	29.9082	28.9753	27.9408	27.3821	28.0531	28.7837	29.8906	31.1621	32.2005	(42b)
Hot water usage for other uses	45.5525	43.8960	42.2396	40.5831	38.9267	37.2702	37.2702	38.9267	40.5831	42.2396	43.8960	45.5525	(42c)
Average daily hot water use (litres/day)													71.3675 (43)
Daily hot water use	77.8622	75.7259	73.3937	70.4913	67.9020	65.2111	64.6523	66.9797	69.3668	72.1301	75.0582	77.7530	(44)
Energy content	123.3147	107.8326	112.8034	96.4991	91.4091	80.1846	78.1913	82.9349	85.5362	97.8799	106.9341	121.7423	(45)
Energy content (annual)													Total = Sum(45)m = 1185.2624
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	104.8175	91.6578	95.8829	82.0243	77.6977	68.1569	66.4626	70.4947	72.7058	83.1979	90.8940	103.4810	(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	(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	104.8175	91.6578	95.8829	82.0243	77.6977	68.1569	66.4626	70.4947	72.7058	83.1979	90.8940	103.4810	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 1007.4730 (64)
Electric shower(s)	59.9396	53.4067	58.3181	55.6522	56.6965	54.0830	55.8858	56.6965	55.6522	58.3181	57.2215	59.9396	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													681.8100 (64a)
Heat gains from water heating, kWh/month	41.1893	36.2661	38.5502	34.4191	33.5986	30.5600	30.5871	31.7978	32.0895	35.3790	37.0289	40.8552	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.8623	234.5619	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623	218.9244	211.8623	218.9244	211.8623	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	383.7015	387.6832	377.6496	356.2893	329.3259	303.9840	287.0541	283.0724	293.1060	314.4662	341.4297	366.7716 (68)
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)	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791 (71)
Water heating gains (Table 5)	55.3619	53.9674	51.8148	47.8043	45.1594	42.4444	41.1117	42.7390	44.5687	47.5524	51.4290	54.9128 (72)
Total internal gains	719.2180	744.5046	709.6190	691.3103	654.6397	633.6450	608.3203	605.9659	624.8913	642.1732	680.0753	701.8390 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
North	17.5000	10.6334	0.6300	0.7000	0.7700	0.7700	56.8698 (74)					
East	7.5300	19.6403	0.6300	0.7000	0.7700	0.7700	45.1975 (76)					
South	2.2400	46.7521	0.6300	0.7000	0.7700	0.7700	32.0052 (78)					
Solar gains	134.0725	249.5132	397.0531	584.4611	738.4907	769.8769	726.9709	606.5452	461.1367	290.8194	164.4492	112.2331 (83)
Total gains	853.2905	994.0179	1106.6720	1275.7714	1393.1305	1403.5218	1335.2912	1212.5111	1086.0280	932.9926	844.5246	814.0721 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, ni1,m (see Table 9a)	36.1881	36.2393	36.2896	36.5277	36.5726	36.7831	36.7831	36.8223	36.7017	36.5726	36.4819	36.3875
tau	3.4125	3.4160	3.4193	3.4352	3.4382	3.4522	3.4522	3.4548	3.4468	3.4382	3.4321	3.4258
util living area	0.9936	0.9887	0.9788	0.9480	0.8782	0.7463	0.6045	0.6671	0.8639	0.9663	0.9892	0.9946 (86)
MIT	18.7250	18.9540	19.3328	19.8870	20.4030	20.7749	20.9214	20.8881	20.5876	19.9248	19.2352	18.6865 (87)
Th 2	20.1080	20.1091	20.1102	20.1155	20.1165	20.1211	20.1211	20.1220	20.1194	20.1165	20.1145	20.1124 (88)
util rest of house	0.9925	0.9866	0.9746	0.9367	0.8495	0.6834	0.5064	0.5724	0.8207	0.9571	0.9868	0.9936 (89)
MIT 2	17.9931	18.2219	18.5992	19.1485	19.6428	19.9756	20.0848	20.0660	19.8233	19.1921	18.5069	17.9577 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2266	18.4554	18.8332	19.3841	19.8853	20.2306	20.3516	20.3282	20.0671	19.4258	18.7392	18.1902 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2266	18.4554	18.8332	19.3841	19.8853	20.2306	20.3516	20.3282	20.0671	19.4258	18.7392	18.1902 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9889	0.9811	0.9665	0.9251	0.8407	0.6920	0.5338	0.5965	0.8177	0.9476	0.9817	0.9905 (94)
Useful gains	843.8473	975.2716	1069.6018	1180.1821	1171.2473	971.2785	712.7183	723.2218	887.9945	884.0660	829.0435	806.3670 (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	2885.6830	2804.8074	2548.3890	2152.1821	1678.2277	1147.8224	764.7907	799.9401	1219.1249	1809.5418	2392.3110	2882.9813 (97)
Space heating kWh	1519.1257	1229.4480	1100.2177	699.8400	377.1935	0.0000	0.0000	0.0000	0.0000	688.5540	1125.5526	1545.0011 (98a)
Space heating requirement - total per year (kWh/year)	8284.9327											
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	1519.1257	1229.4480	1100.2177	699.8400	377.1935	0.0000	0.0000	0.0000	0.0000	688.5540	1125.5526	1545.0011 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8284.9327											
Space heating per m2	(98c) / (4) = 38.8053 (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	1916.2451	1508.5334	1547.6535	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6818	0.7614	0.7092	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1306.5804	1148.6050	1097.6706	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1531.0710	1455.8128	1316.7458	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	161.6332	228.5625	162.9919	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	40.4083	57.1406	40.7480	0.0000	0.0000	0.0000	0.0000 (107)

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Space cooling requirement	138.2969 (107)
Energy for space heating	38.8053 (99)
Energy for space cooling	0.6478 (108)
Total	39.4531 (109)
Fabric Energy Efficiency (DFEE)	39.5 (109)

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

 1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	213.5000 (1b)	x 2.7900 (2b)	= 595.6650 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	213.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	595.6650 (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	4 * 10 = 40.0000 (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) =	40.0000 / (5) = 0.0672 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3172 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3172 (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	0.4044	0.3964	0.3885	0.3489	0.3409	0.3013	0.3013	0.2934	0.3172	0.3409	0.3568	0.3727 (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	0.5818	0.5786	0.5755	0.5609	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5637	0.5694 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			27.2700	1.1450	31.2252		(27)
UNHEATED SPACE BELOW			1.8500	0.1300	0.2405		(28a)
Heatloss Floor 1			132.7200	0.1300	17.2536		(28b)
EXTERNAL	123.4000	27.2700	96.1300	0.1800	17.3034		(29a)
HALLWAY	40.3200	2.9100	37.4100	0.1800	6.7338		(29a)
Flat Roof	30.5900		30.5900	0.1100	3.3649		(30)
Total net area of external elements Aum(A, m ²)			328.8800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 79.0314		(33)
Party Wall 1			37.1900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 126.4375 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.6700	0.0500	0.7835
E3 Sill	8.4400	0.0500	0.4220
E4 Jamb	34.4800	0.0500	1.7240
E20 Exposed floor (normal)	33.7900	0.3200	10.8128
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048

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E7 Party floor between dwellings (in blocks of flats)	10.4400	0.0700	0.7308	
E14 Flat roof	18.9200	0.0800	1.5136	
E16 Corner (normal)	16.7400	0.0900	1.5066	
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6400	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228	
E18 Party wall between dwellings	11.1600	0.0600	0.6696	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				19.1839 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 98.2153 (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	114.3556	113.7316	113.1199	110.2468	109.7092	107.2068	107.2068	106.7434	108.1707	109.7092	110.7967	111.9336 (38)
Heat transfer coeff	212.5709	211.9469	211.3352	208.4621	207.9245	205.4221	205.4221	204.9587	206.3860	207.9245	209.0120	210.1489 (39)
Average = Sum(39)m / 12 =												208.4595

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9956	0.9927	0.9899	0.9764	0.9739	0.9622	0.9622	0.9600	0.9667	0.9739	0.9790	0.9843 (40)
HLP (average)												0.9764
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

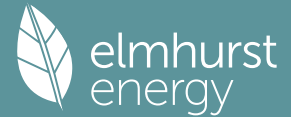
Assumed occupancy													3.0195 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.3097	31.8299	31.1541	29.9082	28.9753	27.9408	27.3821	28.0531	28.7837	29.8906	31.1621	32.2005	(42b)
Hot water usage for other uses	45.5525	43.8960	42.2396	40.5831	38.9267	37.2702	37.2702	38.9267	40.5831	42.2396	43.8960	45.5525	(42c)
Average daily hot water use (litres/day)													71.3675 (43)
Daily hot water use	77.8622	75.7259	73.3937	70.4913	67.9020	65.2111	64.6523	66.9797	69.3668	72.1301	75.0582	77.7530	(44)
Energy conte	123.3147	107.8326	112.8034	96.4991	91.4091	80.1846	78.1913	82.9349	85.5362	97.8799	106.9341	121.7423	(45)
Energy content (annual)													Total = Sum(45)m = 1185.2624
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	104.8175	91.6578	95.8829	82.0243	77.6977	68.1569	66.4626	70.4947	72.7058	83.1979	90.8940	103.4810	(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	104.8175	91.6578	95.8829	82.0243	77.6977	68.1569	66.4626	70.4947	72.7058	83.1979	90.8940	103.4810	(64)
													Total per year (kWh/year) = Sum(64)m = 1007.4730 (64)
12Total per year (kWh/year)													1007 (64)
Electric shower(s)	59.9396	53.4067	58.3181	55.6522	56.6965	54.0830	55.8858	56.6965	55.6522	58.3181	57.2215	59.9396	(64a)
													Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 681.8100 (64a)
Heat gains from water heating, kWh/month	41.1893	36.2661	38.5502	34.4191	33.5986	30.5600	30.5871	31.7978	32.0895	35.3790	37.0289	40.8552	(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	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.8623	234.5619	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623	218.9244	211.8623	218.9244	211.8623 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	383.7015	387.6832	377.6496	356.2893	329.3259	303.9840	287.0541	283.0724	293.1060	314.4662	341.4297	366.7716 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974 (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)	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791 (71)
Water heating gains (Table 5)	55.3619	53.9674	51.8148	47.8043	45.1594	42.4444	41.1117	42.7390	44.5687	47.5524	51.4290	54.9128 (72)
Total internal gains	719.2180	744.5046	709.6190	691.3103	654.6397	633.6450	608.3203	605.9659	624.8913	642.1732	680.0753	701.8390 (73)

6. Solar gains

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[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
East	7.5300	19.6403	0.6300	0.7000	0.7700	45.1975 (76)
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)

Solar gains	134.0725	249.5132	397.0531	584.4611	738.4907	769.8769	726.9709	606.5452	461.1367	290.8194	164.4492	112.2331 (83)
Total gains	853.2905	994.0179	1106.6720	1275.7714	1393.1305	1403.5218	1335.2912	1212.5111	1086.0280	932.9926	844.5246	814.0721 (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, ni1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.2750	35.3789	35.4813	35.9703	36.0633	36.5026	36.5026	36.5852	36.3321	36.0633	35.8757	35.6816
alpha	3.3517	3.3586	3.3654	3.3980	3.4042	3.4335	3.4335	3.4390	3.4221	3.4042	3.3917	3.3788
util living area	0.9936	0.9887	0.9790	0.9487	0.8802	0.7485	0.6073	0.6693	0.8655	0.9667	0.9892	0.9946 (86)
MIT	18.6655	18.8991	19.2855	19.8596	20.3845	20.7693	20.9188	20.8853	20.5779	19.9035	19.2024	18.6409 (87)
Th 2	20.0870	20.0894	20.0918	20.1030	20.1052	20.1150	20.1150	20.1168	20.1112	20.1052	20.1009	20.0964 (88)
util rest of house	0.9924	0.9866	0.9748	0.9375	0.8516	0.6855	0.5086	0.5742	0.8224	0.9574	0.9868	0.9936 (89)
MIT 2	17.9193	18.1535	18.5394	19.1127	19.6169	19.9659	20.0775	20.0595	19.8082	19.1630	18.4647	17.9013 (90)
Living area fraction	flA = Living area / (4) =											
MIT	18.1573	18.3913	18.7774	19.3509	19.8617	20.2222	20.3458	20.3229	20.0537	19.3992	18.7000	18.1372 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1573	18.3913	18.7774	19.3509	19.8617	20.2222	20.3458	20.3229	20.0537	19.3992	18.7000	18.1372 (93)

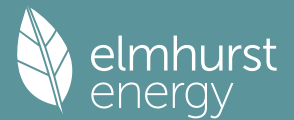
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9888	0.9810	0.9666	0.9257	0.8425	0.6939	0.5360	0.5983	0.8191	0.9478	0.9816	0.9904 (94)
Useful gains	843.7174	975.1797	1069.7069	1180.9638	1173.6579	973.9087	715.6706	725.3899	889.5384	884.3015	828.9852	806.2721 (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	2945.6616	2859.4449	2594.6368	2178.6195	1697.0253	1154.9184	769.4765	804.0343	1228.7665	1829.5695	2424.5399	2928.8933 (97)
Space heating kWh	1563.8464	1266.2262	1134.5479	718.3121	389.3853	0.0000	0.0000	0.0000	0.0000	703.2794	1148.7994	1579.2302 (98a)
Space heating requirement - total per year (kWh/year)												8503.6268
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	1563.8464	1266.2262	1134.5479	718.3121	389.3853	0.0000	0.0000	0.0000	0.0000	703.2794	1148.7994	1579.2302 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8503.6268
Space heating per m2												(98c) / (4) = 39.8296 (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	1930.9680	1520.1238	1557.6863	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6777	0.7574	0.7058	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1308.6271	1151.3754	1099.3664	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1531.0710	1455.8128	1316.7458	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	160.1596	226.5014	161.7302	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.0399	56.6254	40.4326	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												137.0978 (107)
Energy for space heating												39.8296 (99)
Energy for space cooling												0.6421 (108)
Total												40.4718 (109)
Fabric Energy Efficiency (TFEE)												40.5 (109)

Predicted Energy Assessment

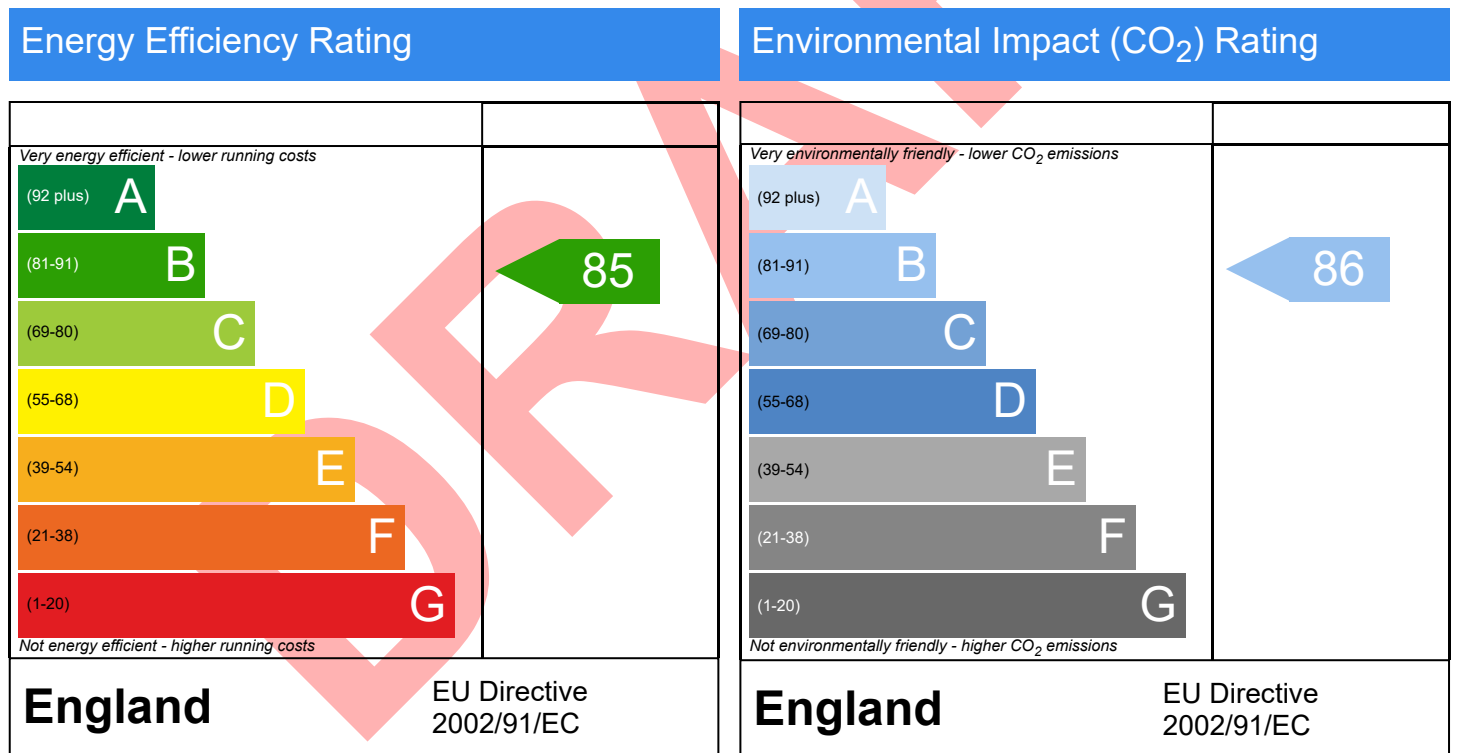


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Semi-Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 213.5 m²
 DRRN:

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.

Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Semi-Detached
Floor Area [m ²]	214

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

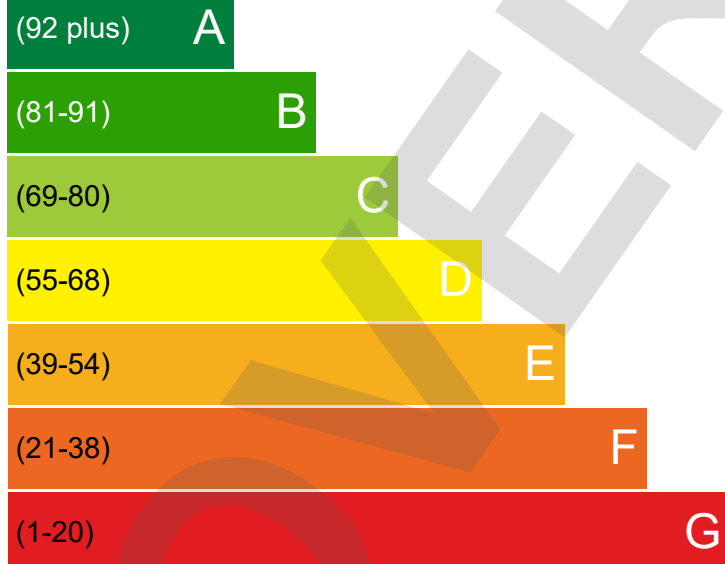
Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL



85

85

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.13 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 69 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **2.7** per year

With the recommended measures the potential CO emissions could be: **3** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£818

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:05

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Semi-detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	214 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 3 - Heatpump + PV
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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	10.22 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	1.75 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	53.82 kWh _{PE} /m ²		
Dwelling primary energy	17.85 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	40.5 kWh/m ²		
Dwelling fabric energy efficiency	39.5 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.14	Heatloss Floor 1 (0.14)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	EAST (1.2)	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)	96.13	0.18
Sheltered wall: Walls (2)	37.41	0.18
Party wall: Party Wall (1)	37.19	0 (!)
Upper floor: Heatloss Floor 1, Heatloss Floor 1	132.72	0.14
Exposed roof: Roof (1)	30.59	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
EAST, Windows	7.53	East	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	West	N/A	1.2
SOUTH, Windows	2.24	South	0.7	1.2
NORTH, Windows	17.5	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E20: Exposed floor (normal)	Calculated by person with suitable expertise	0.32	
External wall	E21: Exposed floor (inverted)	Calculated by person with suitable expertise	0.32	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

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		3 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	442.3%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	MIDEA
Model	MHC-V16W/D2N8-B
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	500 litres
Declared heat loss	2.1 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		

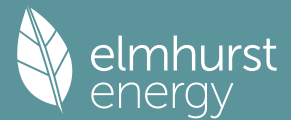
9 Local generation	
Technology type: Photovoltaic system (1)	
Peak power	1.79 kWp
Orientation	South
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks	
N/A	

11 Supporting documentary evidence	
N/A	

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:
b. Client Declaration	
N/A	

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 3 - Heatpump + PV	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	91 B	DER	1.75	TER	10.22
Environmental	98 A	% DER < TER			82.88
CO ₂ Emissions (t/year)	0.35	DFEE	39.45	TFEE	40.47
Compliance Check	See BREL	% DFEE < TFEE			2.52
% DPER < TPER	66.82	DPER	17.85	TPER	53.82

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
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	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	213.50 m ²	2.79 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	68.10	m ²
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9.0 External Walls	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
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	123.40	96.13	0.00	None	27.27	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	40.32	37.41	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	37.19	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	30.59	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	182.91

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor 1	Exposed Floor - Solid	Lowest occupied	Other	0.14	Garage Double 1 Inside	0.60	0.00	132.72
UNHEATED SPACE BELOW	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.14	Stairwell Access Corridor 1	0.50	110.00	1.85

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	78.93

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
EAST	Windows	EXTERNAL	East	7.53	0
ENTRANCE DOOR	Entrance Door	HALLWAY	West	2.91	0
SOUTH	Windows	EXTERNAL	South	2.24	0
NORTH	Windows	EXTERNAL	North	17.50	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	15.67	0.30	0.30	No
E3 Sill	Independently assessed	8.44	0.04	0.04	No
E4 Jamb	Independently assessed	34.48	0.05	0.05	No
E20 Exposed floor (normal)	Independently assessed	33.79	0.32	0.32	No
E21 Exposed floor (inverted)	Independently assessed	6.89	0.32	0.32	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	10.44	0.07	0.07	No
E14 Flat roof	Independently assessed	18.92	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.74	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	16.74	-0.09	-0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	28.64	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	2.69	0.12	0.12	No
E18 Party wall between dwellings	Independently assessed	11.16	0.06	0.06	No

Y-value W/m²K

18.0 Pressure Testing

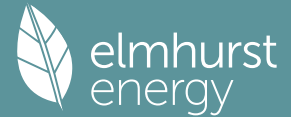
Designed AP ₅₀	<input type="text" value="3.00"/>	m³/(h.m²) @ 50 Pa
Property Tested?	<input type="text" value="Yes"/>	
Test Method	<input type="text" value="Blower Door"/>	
As Built AP ₅₀	<input type="text" value="0.10"/>	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	<input type="text" value="Yes"/>
Approved Installation	<input type="text" value="No"/>
Mechanical Ventilation data Type	<input type="text" value="Database"/>
Type	<input type="text" value="Mechanical extract ventilation - centralised"/>
MV Reference Number	<input type="text" value="500808"/>
Configuration	<input type="text" value="4"/>
Manufacturer SFP	<input type="text" value="0.18"/>
Duct Type	<input type="text" value="Rigid"/>

Summary for Input Data



MVHR Efficiency	0.00
Wet Rooms	4
SFP from Installer Commissioning Certificate	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Database

Percentage of Heat %

Database Ref. No.

Fuel Type

SAP Code

In Winter

In Summer

Model Name

Manufacturer

System Type

Controls SAP Code

Delayed Start Stat

Burner Control

HETAS approved System

Oil Pump Inside

FI Case

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heating Pump Age

Heat Emitter

Underfloor Heating

Flow Temperature

Flow Temperature Value

Boiler Interlock

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

26.0 Heat Networks

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Summary for Input Data

Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	No
Summer Immersion	No
Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Insulation Thickness Type	80 mm	
Insulation Thickness	80	
Cylinder Volume	500.00	L
Loss	2.10	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store

None

32.0 Photovoltaic Unit

One Dwelling	
Export Capable Meter?	No
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
1.79	South	30°	None Or Little	No	No	1.00		PV

34.0 Small-scale Hydro

None											
Electricity Generated	0.00										
Apportioned	0.00	kWh/Year									
Connected to dwelling's electricity meter	Yes										
Electricity Generation	Annual										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

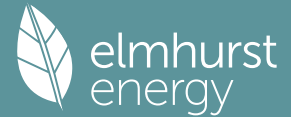
Lower cost measures

None

Further measures to achieve even higher standards

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

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 3 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	91 B	DER	1.75	TER	10.22
Environmental	98 A	% DER < TER			82.88
CO ₂ Emissions (t/year)	0.35	DFEE	39.45	TFEE	40.47
Compliance Check	See BREL	% DFEE < TFEE			2.52
% DPER < TPER	66.82	DPER	17.85	TPER	53.82
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	213.5000 (1b)	2.7900 (2b)	595.6650 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	213.5000		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 595.6650 (5)

2. Ventilation rate

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

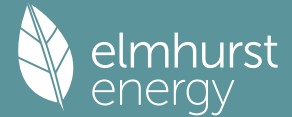
	Value	Reference
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			27.2700	1.1450	31.2252		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
UNHEATED SPACE BELOW			1.8500	0.1308	0.2421	110.0000	203.5000 (28a)
Heatloss Floor 1			132.7200	0.1292	17.1410		(28b)

Full SAP Calculation Printout



EXTERNAL	123.4000	27.2700	96.1300	0.1800	17.3034	70.0000	6729.1000 (29a)
HALLWAY	40.3200	2.9100	37.4100	0.1700	6.3597	70.0000	2618.7000 (29a)
Flat Roof	30.5900		30.5900	0.1100	3.3649	9.0000	275.3100 (30)
Total net area of external elements Aum(A, m2)			328.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	79.1282			(33)
Party Wall 1			37.1900	0.0000	0.0000	180.0000	6694.2000 (32)
Party Floor 1			78.9300			40.0000	3157.2000 (32d)
Party Ceiling 1			182.9100			30.0000	5487.3000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25165.3100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 117.8703 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.6700	0.3000	4.7010
E3 Sill	8.4400	0.0400	0.3376
E4 Jamb	34.4800	0.0500	1.7240
E20 Exposed floor (normal)	33.7900	0.3200	10.8128
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.4400	0.0700	0.7308
E14 Flat roof	18.9200	0.0400	0.7568
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			22.2602 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 101.3884 (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	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847	98.2847 (38)
Heat transfer coeff	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731	199.6731 (39)
Average = Sum(39)m / 12 =												199.6731

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352	0.9352 (40)
HLP (average)												0.9352
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

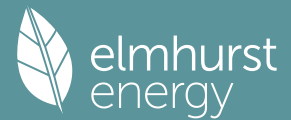
4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0195 (42)

Hot water usage for mixer showers	74.8466	73.7218	72.0827	68.9467	66.6324	64.0515	62.5845	64.2112	65.9943	68.7654	71.9688	74.5598 (42a)
Hot water usage for baths	34.0102	33.5051	32.7938	31.4823	30.5003	29.4114	28.8232	29.5296	30.2986	31.4638	32.8023	33.8952 (42b)
Hot water usage for other uses	47.9500	46.2063	44.4627	42.7191	40.9754	39.2318	39.2318	40.9754	42.7191	44.4627	46.2063	47.9500 (42c)
Average daily hot water use (litres/day)												144.1298 (43)
Daily hot water use	156.8068	153.4333	149.3393	143.1481	138.1082	132.6947	130.6396	134.7162	139.0119	144.6918	150.9774	156.4050 (44)
Energy conte	248.3436	218.4869	229.5289	195.9626	185.9201	163.1636	157.9972	166.8067	171.4156	196.3455	215.0949	244.8925 (45)
Energy content (annual)												Total = Sum(45)m = 2393.9583
Distribution loss (46)m = 0.15 x (45)m	37.2515	32.7730	34.4293	29.3944	27.8880	24.4745	23.6996	25.0210	25.7123	29.4518	32.2642	36.7339 (46)
Water storage loss:												500.0000 (47)
Store volume												2.1000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.1340 (55)
Enter (49) or (54) in (55)												
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	306.7600	271.2501	287.9453	252.4946	244.3365	219.6956	216.4136	225.2231	227.9476	254.7619	271.6269	303.3089 (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	306.7600	271.2501	287.9453	252.4946	244.3365	219.6956	216.4136	225.2231	227.9476	254.7619	271.6269	303.3089 (64)
Total per year (kWh/year) = Sum(64)m =												3081.7643 (64)
12Total per year (kWh/year)												3082 (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	129.3074	114.8575	123.0515	110.3832	108.5516	99.4775	99.2672	102.1964	102.2213	112.0180	116.7447	128.1599 (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	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.8623	234.5619	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623	218.9244	211.8623	218.9244	211.8623	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	383.7015	387.6832	377.6496	356.2893	329.3259	303.9840	287.0541	283.0724	293.1060	314.4662	341.4297	366.7716	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	(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)	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	(71)
Water heating gains (Table 5)	173.8002	170.9188	165.3918	153.3100	145.9026	138.1632	133.4237	137.3607	141.9740	150.5618	162.1454	172.2579	(72)
Total internal gains	837.6563	861.4560	823.1959	796.8159	755.3830	729.3638	700.6322	700.5876	722.2966	745.1826	790.7917	819.1840	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)							
East	7.5300	19.6403	0.6300	0.7000	0.7700	45.1975 (76)							
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)							
Solar gains	134.0725	249.5132	397.0531	584.4611	738.4907	769.8769	726.9709	606.5452	461.1367	290.8194	164.4492	112.2331	(83)
Total gains	971.7288	1110.9693	1220.2490	1381.2770	1493.8737	1499.2406	1427.6031	1307.1328	1183.4333	1036.0019	955.2409	931.4171	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	35.0090	21.0000 (85)
tau	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	3.3339	
util living area	0.9883	0.9809	0.9668	0.9271	0.8449	0.7045	0.5620	0.6204	0.8239	0.9481	0.9811	0.9899	(86)
Living	19.2614	19.4342	19.7181	20.1204	20.4953	20.7540	20.8548	20.8331	20.6285	20.1489	19.6330	19.2210	
Non living	18.0583	18.2784	18.6395	19.1449	19.6010	19.8915	19.9873	19.9710	19.7640	19.1870	18.5336	18.0066	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.1106	19.4342	19.7181	20.1204	20.4953	20.7540	20.8548	20.8331	20.6285	20.1489	19.6330	19.4698	(87)
Th 2	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	20.1377	(88)
util rest of house	0.9864	0.9776	0.9608	0.9131	0.8132	0.6418	0.4697	0.5295	0.7763	0.9355	0.9773	0.9882	(89)
MIT 2	19.3087	18.2784	18.6395	19.1449	19.6010	19.8915	19.9873	19.9710	19.7640	19.1870	18.5336	18.3906	(90)
Living area fraction									fLA = Living area / (4) =			0.3190	(91)
MIT	19.5645	18.6471	18.9835	19.4561	19.8863	20.1666	20.2640	20.2460	20.0397	19.4938	18.8843	18.7349	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5645	18.6471	18.9835	19.4561	19.8863	20.1666	20.2640	20.2460	20.0397	19.4938	18.8843	18.7349	(93)

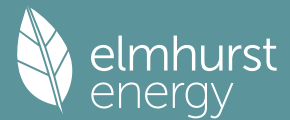
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9848	0.9702	0.9506	0.8997	0.8026	0.6441	0.4840	0.5418	0.7701	0.9235	0.9700	0.9845	(94)
Useful gains	956.9809	1077.8980	1159.9513	1242.7378	1198.9824	965.6238	690.9603	708.1989	911.3598	956.7535	926.5677	917.0080	(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	3047.9033	2744.9218	2492.6241	2107.7656	1634.5801	1111.4990	731.6023	767.9399	1186.0083	1775.8600	2352.9984	2902.2191	(97)
Space heating kWh	1555.6462	1120.2400	991.5086	622.8200	324.0847	0.0000	0.0000	0.0000	0.0000	609.4152	1027.0301	1476.9970	(98a)
Space heating requirement - total per year (kWh/year)												7727.7418	
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	1555.6462	1120.2400	991.5086	622.8200	324.0847	0.0000	0.0000	0.0000	0.0000	609.4152	1027.0301	1476.9970	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7727.7418	
Space heating per m2										(98c) / (4) =		36.1955	(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 %)	442.3211	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	1555.6462	1120.2400	991.5086	622.8200	324.0847	0.0000	0.0000	0.0000	0.0000	609.4152	1027.0301	1476.9970	(98)
Space heating efficiency (main heating system 1)	442.3211	442.3211	442.3211	442.3211	442.3211	0.0000	0.0000	0.0000	0.0000	442.3211	442.3211	442.3211	(210)
Space heating fuel (main heating system)	351.7007	253.2640	224.1604	140.8072	73.2691	0.0000	0.0000	0.0000	0.0000	137.7767	232.1911	333.9196	(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	306.7600	271.2501	287.9453	252.4946	244.3365	219.6956	216.4136	225.2231	227.9476	254.7619	271.6269	303.3089	(64)
Efficiency of water heater	285.9016	285.9016	285.9016	285.9016	285.9016	285.9016	285.9016	285.9016	285.9016	285.9016	285.9016	285.9016	(216)
Fuel for water heating, kWh/month	107.2957	94.8753	100.7148	88.3152	85.4618	76.8431	75.6952	78.7765	79.7294	89.1082	95.0071	106.0886	(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	15.5536	14.0484	15.5536	15.0519	15.5536	15.0519	15.5536	15.5536	15.0519	15.5536	15.0519	15.5536	(231)
Lighting	40.9616	32.8609	29.5876	21.6772	16.7441	13.6800	15.2745	19.8544	25.7889	33.8364	38.2181	42.1001	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.1714	-55.0941	-85.4328	-102.3282	-114.0436	-103.9170	-102.5112	-94.0133	-79.7299	-64.9080	-40.8810	-30.7186	(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													1747.0887 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													285.9016
Water heating fuel used													1077.9109 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)													
mechanical ventilation fans (SFP = 0.2520)													183.1312 (230a)
Total electricity for the above, kWh/year													183.1312 (231)
Electricity for lighting (calculated in Appendix L)													330.5837 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-909.7491 (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													2428.9655 (238)

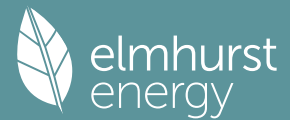
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1747.0887	0.1546	270.1803	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1077.9109	0.1409	151.9192	(264)
Space and water heating			422.0995	(265)
Pumps, fans and electric keep-hot	183.1312	0.1387	25.4026	(267)
Energy for lighting	330.5837	0.1443	47.7134	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-909.7491	0.1336	-121.5819	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-121.5819	(269)
Total CO2, kg/year			373.6336	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7500	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year

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Space heating - main system 1	1747.0887	1.5725	2747.3205 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1077.9109	1.5211	1639.6550 (278)
Space and water heating			4386.9756 (279)
Pumps, fans and electric keep-hot	183.1312	1.5128	277.0410 (281)
Energy for lighting	330.5837	1.5338	507.0603 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-909.7491	1.4939	-1359.0566
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1359.0566 (283)
Total Primary energy kWh/year			3812.0203 (286)
Dwelling Primary energy Rate (DPER)			17.8500 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	213.5000 (1b)	x 2.7900 (2b)	= 595.6650 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	213.5000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 595.6650 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0672 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3172 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3172 (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	0.4044	0.3964	0.3885	0.3489	0.3409	0.3013	0.3013	0.2934	0.3172	0.3409	0.3568	0.3727 (22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5637	0.5694 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			27.2700	1.1450	31.2252		(27)
UNHEATED SPACE BELOW			1.8500	0.1300	0.2405		(28a)
Heatloss Floor 1			132.7200	0.1300	17.2536		(28b)
EXTERNAL	123.4000	27.2700	96.1300	0.1800	17.3034		(29a)
HALLWAY	40.3200	2.9100	37.4100	0.1800	6.7338		(29a)
Flat Roof	30.5900		30.5900	0.1100	3.3649		(30)
Total net area of external elements Aum(A, m2)			328.8800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.0314		(33)
Party Wall 1			37.1900	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							126.4375 (35)
List of Thermal Bridges							

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	Length	Psi-value	Total
K1 Element	15.6700	0.0500	0.7835
E2 Other lintels (including other steel lintels)	8.4400	0.0500	0.4220
E3 Sill	34.4800	0.0500	1.7240
E4 Jamb	33.7900	0.3200	10.8128
E20 Exposed floor (normal)	6.8900	0.3200	2.2048
E21 Exposed floor (inverted)	10.4400	0.0700	0.7308
E7 Party floor between dwellings (in blocks of flats)	18.9200	0.0800	1.5136
E14 Flat roof	16.7400	0.0900	1.5066
E16 Corner (normal)	16.7400	-0.0900	-1.5066
E17 Corner (inverted - internal area greater than external area)	28.6400	0.0000	0.0000
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	2.6900	0.1200	0.3228
P4 Party wall - Roof (insulation at ceiling level)	11.1600	0.0600	0.6696
E18 Party wall between dwellings			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.1839 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			98.2153 (37) (33) + (36) + (36a) =

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	114.3556	113.7316	113.1199	110.2468	109.7092	107.2068	107.2068	106.7434	108.1707	109.7092	110.7967	111.9336 (38)
Heat transfer coeff	212.5709	211.9469	211.3352	208.4621	207.9245	205.4221	205.4221	204.9587	206.3860	207.9245	209.0120	210.1489 (39)
Average = Sum(39)m / 12 =												208.4595

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9956	0.9927	0.9899	0.9764	0.9739	0.9622	0.9622	0.9600	0.9667	0.9739	0.9790	0.9843 (40)
HLP (average)												0.9764
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0195 (42)

Hot water usage for mixer showers 74.8466 73.7218 72.0827 68.9467 66.6324 64.0515 62.5845 64.2112 65.9943 68.7654 71.9688 74.5598 (42a)

Hot water usage for baths 32.3097 31.8299 31.1541 29.9082 28.9753 27.9408 27.3821 28.0531 28.7837 29.8906 31.1621 32.2005 (42b)

Hot water usage for other uses 45.5525 43.8960 42.2396 40.5831 38.9267 37.2702 37.2702 38.9267 40.5831 42.2396 43.8960 45.5525 (42c)

Average daily hot water use (litres/day) 140.3736 (43)

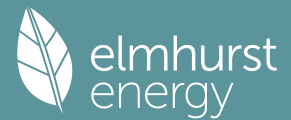
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	152.7088	149.4477	145.4764	139.4381	134.5344	129.2626	127.2368	131.1909	135.3611	140.8955	147.0269	152.3128 (44)
Energy conte	241.8534	212.8115	223.5919	190.8837	181.1091	158.9434	153.8819	162.4417	166.9137	191.1939	209.4668	238.4850 (45)
Energy content (annual)												Total = Sum(45)m = 2331.5761
Distribution loss (46)m = 0.15 x (45)m	36.2780	31.9217	33.5388	28.6326	27.1664	23.8415	23.0823	24.3663	25.0371	28.6791	31.4200	35.7728 (46)
Water storage loss:												
Store volume												500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.9009 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.5665 (55)
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (56)
If cylinder contains dedicated solar storage												
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	313.6765	277.6840	295.4150	260.3900	252.9322	228.4496	225.7050	234.2649	236.4200	263.0170	278.9731	310.3081 (62)
WWHRS	-34.2167	-30.2616	-31.6882	-26.2391	-24.4539	-20.9253	-19.6142	-20.8577	-21.6502	-25.5232	-28.9146	-33.5831 (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	279.4597	247.4224	263.7268	234.1509	228.4784	207.5243	206.0908	213.4072	214.7698	237.4939	250.0584	276.7250 (64)
Total per year (kWh/year) = Sum(64)m =												2859.3077 (64)
12Total per year (kWh/year)												2859 (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	137.8747	122.6578	131.8028	119.0738	117.6773	108.4537	108.6242	111.4704	111.1038	121.0305	125.2527	136.7548 (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	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.8623	234.5619	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623	218.9244	211.8623	218.9244	211.8623 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	383.7015	387.6832	377.6496	356.2893	329.3259	303.9840	287.0541	283.0724	293.1060	314.4662	341.4297	366.7716 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791 (71)

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Water heating gains (Table 5)	185.3155	182.5265	177.1543	165.3803	158.1684	150.6301	146.0003	149.8258	154.3108	162.6753	173.9621	183.8102 (72)
Total internal gains	852.1716	876.0637	837.9584	811.8863	770.6488	741.8307	713.2089	713.0527	734.6334	760.2961	805.6084	833.7363 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)	
East	7.5300	19.6403	0.6300	0.7000	0.7700	45.1975 (76)	
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)	

Solar gains	134.0725	249.5132	397.0531	584.4611	738.4907	769.8769	726.9709	606.5452	461.1367	290.8194	164.4492	112.2331 (83)
Total gains	986.2440	1125.5769	1235.0115	1396.3474	1509.1395	1511.7075	1440.1798	1319.5979	1195.7701	1051.1155	970.0577	945.9694 (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	35.2750	35.3789	35.4813	35.9703	36.0633	36.5026	36.5026	36.5852	36.3321	36.0633	35.8757	35.6816
alpha	3.3517	3.3586	3.3654	3.3980	3.4042	3.4335	3.4335	3.4390	3.4221	3.4042	3.3917	3.3788
util living area	0.9901	0.9837	0.9714	0.9354	0.8579	0.7176	0.5735	0.6317	0.8362	0.9540	0.9837	0.9914 (86)
MIT	18.7767	19.0067	19.3861	19.9428	20.4441	20.7993	20.9320	20.9045	20.6302	19.9912	19.3056	18.7521 (87)
Th 2	20.0870	20.0894	20.0918	20.1030	20.1052	20.1150	20.1150	20.1168	20.1112	20.1052	20.1009	20.0964 (88)
util rest of house	0.9883	0.9807	0.9659	0.9218	0.8260	0.6528	0.4769	0.5369	0.7879	0.9418	0.9802	0.9899 (89)
MIT 2	17.4472	17.7420	18.2264	18.9339	19.5458	19.9513	20.0754	20.0570	19.7773	19.0041	18.1323	17.4216 (90)
Living area fraction	fLA = Living area / (4) =											0.3190 (91)
MIT	17.8713	18.1454	18.5963	19.2557	19.8324	20.2218	20.3487	20.3273	20.0493	19.3190	18.5066	17.8460 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8713	18.1454	18.5963	19.2557	19.8324	20.2218	20.3487	20.3273	20.0493	19.3190	18.5066	17.8460 (93)

8. Space heating requirement

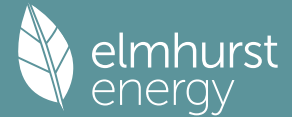
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9818	0.9717	0.9534	0.9058	0.8147	0.6613	0.5038	0.5611	0.7840	0.9277	0.9714	0.9841 (94)
Useful gains	968.2952	1093.6674	1177.4311	1264.7729	1229.5694	999.6629	725.5285	740.3961	937.4831	975.1653	942.2715	930.9024 (95)
Ext temp.	4.3000	4.9000	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	2884.8556	2807.3271	2556.3801	2158.7755	1690.9184	1154.8394	770.0587	804.9437	1227.8561	1812.8914	2384.1062	2867.6858 (97)
Space heating kWh	1425.9210	1151.5794	1025.9381	643.6818	343.2437	0.0000	0.0000	0.0000	0.0000	623.2683	1038.1210	1440.9668 (98a)
Space heating requirement - total per year (kWh/year)												7692.7200
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	1425.9210	1151.5794	1025.9381	643.6818	343.2437	0.0000	0.0000	0.0000	0.0000	623.2683	1038.1210	1440.9668 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7692.7200
Space heating per m2												(98c) / (4) = 36.0315 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1425.9210	1151.5794	1025.9381	643.6818	343.2437	0.0000	0.0000	0.0000	0.0000	623.2683	1038.1210	1440.9668 (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)	1544.8764	1247.6483	1111.5255	697.3801	371.8783	0.0000	0.0000	0.0000	0.0000	675.2635	1124.7248	1561.1775 (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

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Water heating requirement	279.4597	247.4224	263.7268	234.1509	228.4784	207.5243	206.0908	213.4072	214.7698	237.4939	250.0584	276.7250 (64)
Efficiency of water heater (217)m	87.1886	87.0634	86.7982	86.2066	84.9703	79.8000	79.8000	79.8000	79.8000	86.1201	86.8976	79.8000 (216)
Fuel for water heating, kWh/month	320.5232	284.1865	303.8392	271.6159	268.8921	260.0555	258.2592	267.4275	269.1351	275.7704	287.7623	87.2153 (217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	44.0208	35.3151	31.7974	23.2961	17.9946	14.7017	16.4153	21.3372	27.7149	36.3634	41.0724	45.2443 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-52.4178	-75.2059	-109.9250	-125.6463	-137.0903	-128.3762	-126.6672	-118.7504	-105.1175	-86.8184	-58.0448	-45.1566 (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	-25.7337	-54.5511	-109.2536	-165.3558	-219.9535	-221.6214	-219.1435	-185.0484	-134.8877	-78.5735	-34.5265	-20.3281 (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												8334.4745 (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												3384.7562 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												355.2731 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2638.1931 (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												9522.3108 (238)

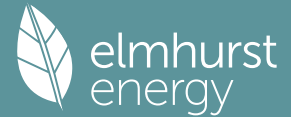
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	8334.4745	0.2100	1750.2396 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3384.7562	0.2100	710.7988 (264)
Space and water heating			2461.0385 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	355.2731	0.1443	51.2769 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1169.2164	0.1343	-156.9811
PV Unit electricity exported	-1468.9767	0.1257	-184.5843
Total			-341.5654 (269)
Total CO2, kg/year			2182.6792 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.2200 (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	8334.4745	1.1300	9417.9562 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3384.7562	1.1300	3824.7746 (278)
Space and water heating			13242.7307 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	355.2731	1.5338	544.9298 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1169.2164	1.4962	-1749.3711
PV Unit electricity exported	-1468.9767	0.4612	-677.5324
Total			-2426.9035 (283)
Total Primary energy kWh/year			11490.8579 (286)
Target Primary Energy Rate (TPER)			53.8200 (287)

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 3 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	91 B	DER	1.75	TER	10.22
Environmental	98 A	% DER < TER			82.88
CO ₂ Emissions (t/year)	0.35	DFEE	39.45	TFEE	40.47
Compliance Check	See BREL	% DFEE < TFEE			2.52
% DPER < TPER	66.82	DPER	17.85	TPER	53.82
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	213.5000 (1b)	2.7900 (2b)	595.6650 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	213.5000		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 595.6650 (5)

2. Ventilation rate

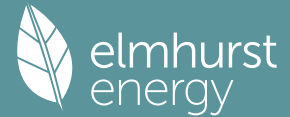
	Value	Reference
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	4 * 10 = 40.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	40.0000 / (5) = 0.0672	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.2172	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2172	(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	0.2769	0.2714	0.2660	0.2389	0.2334	0.2063	0.2063	0.2009	0.2172	0.2334	0.2443	0.2552 (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	0.5383	0.5368	0.5354	0.5285	0.5272	0.5213	0.5213	0.5202	0.5236	0.5272	0.5298	0.5326 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			27.2700	1.1450	31.2252		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
UNHEATED SPACE BELOW			1.8500	0.1308	0.2421	110.0000	203.5000 (28a)
Heatloss Floor 1			132.7200	0.1292	17.1410		(28b)
EXTERNAL	123.4000	27.2700	96.1300	0.1800	17.3034	70.0000	6729.1000 (29a)
HALLWAY	40.3200	2.9100	37.4100	0.1700	6.3597	70.0000	2618.7000 (29a)

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Flat Roof	30.5900	30.5900	0.1100	3.3649	9.0000	275.3100 (30)
Total net area of external elements Aum(A, m2)		328.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	79.1282		(33)
Party Wall 1		37.1900	0.0000	0.0000	180.0000	6694.2000 (32)
Party Floor 1		78.9300			40.0000	3157.2000 (32d)
Party Ceiling 1		182.9100			40.0000	7316.4000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 26994.4100 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 126.4375 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	15.6700	0.3000	4.7010
E3 Sill	8.4400	0.0400	0.3376
E4 Jamb	34.4800	0.0500	1.7240
E20 Exposed floor (normal)	33.7900	0.3200	10.8128
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048
E7 Party floor between dwellings (in blocks of flats)	10.4400	0.0700	0.7308
E14 Flat roof	18.9200	0.0400	0.7568
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.2602 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 101.3884 (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	105.8189	105.5263	105.2395	103.8926	103.6406	102.4675	102.4675	102.2502	102.9193	103.6406	104.1504	104.6834 (38)
Heat transfer coeff	207.2073	206.9147	206.6279	205.2810	205.0290	203.8559	203.8559	203.6386	204.3077	205.0290	205.5388	206.0718 (39)
Average = Sum(39)m / 12 =												205.2798

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9705	0.9692	0.9678	0.9615	0.9603	0.9548	0.9548	0.9538	0.9569	0.9603	0.9627	0.9652 (40)
HLP (average)												0.9615
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

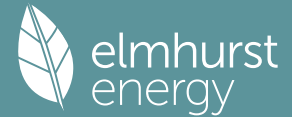
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0195 (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	32.3097	31.8299	31.1541	29.9082	28.9753	27.9408	27.3821	28.0531	28.7837	29.8906	31.1621	32.2005	(42b)
Hot water usage for other uses	45.5525	43.8960	42.2396	40.5831	38.9267	37.2702	37.2702	38.9267	40.5831	42.2396	43.8960	45.5525	(42c)
Average daily hot water use (litres/day)													71.3675 (43)
Daily hot water use	77.8622	75.7259	73.3937	70.4913	67.9020	65.2111	64.6523	66.9797	69.3668	72.1301	75.0582	77.7530	(44)
Energy content	123.3147	107.8326	112.8034	96.4991	91.4091	80.1846	78.1913	82.9349	85.5362	97.8799	106.9341	121.7423	(45)
Energy content (annual)													Total = Sum(45)m = 1185.2624
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	104.8175	91.6578	95.8829	82.0243	77.6977	68.1569	66.4626	70.4947	72.7058	83.1979	90.8940	103.4810	(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	(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	104.8175	91.6578	95.8829	82.0243	77.6977	68.1569	66.4626	70.4947	72.7058	83.1979	90.8940	103.4810	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 1007.4730 (64)
Electric shower(s)	59.9396	53.4067	58.3181	55.6522	56.6965	54.0830	55.8858	56.6965	55.6522	58.3181	57.2215	59.9396	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													681.8100 (64a)
Heat gains from water heating, kWh/month	41.1893	36.2661	38.5502	34.4191	33.5986	30.5600	30.5871	31.7978	32.0895	35.3790	37.0289	40.8552	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.8623	234.5619	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623	218.9244	211.8623	218.9244	211.8623	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	383.7015	387.6832	377.6496	356.2893	329.3259	303.9840	287.0541	283.0724	293.1060	314.4662	341.4297	366.7716 (68)
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)	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791 (71)
Water heating gains (Table 5)	55.3619	53.9674	51.8148	47.8043	45.1594	42.4444	41.1117	42.7390	44.5687	47.5524	51.4290	54.9128 (72)
Total internal gains	719.2180	744.5046	709.6190	691.3103	654.6397	633.6450	608.3203	605.9659	624.8913	642.1732	680.0753	701.8390 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)						
East	7.5300	19.6403	0.6300	0.7000	0.7700	45.1975 (76)						
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)						
Solar gains	134.0725	249.5132	397.0531	584.4611	738.4907	769.8769	726.9709	606.5452	461.1367	290.8194	164.4492	112.2331 (83)
Total gains	853.2905	994.0179	1106.6720	1275.7714	1393.1305	1403.5218	1335.2912	1212.5111	1086.0280	932.9926	844.5246	814.0721 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, ni1,m (see Table 9a)	36.1881	36.2393	36.2896	36.5277	36.5726	36.7831	36.7831	36.8223	36.7017	36.5726	36.4819	36.3875
tau	3.4125	3.4160	3.4193	3.4352	3.4382	3.4522	3.4522	3.4548	3.4468	3.4382	3.4321	3.4258
util living area	0.9936	0.9887	0.9788	0.9480	0.8782	0.7463	0.6045	0.6671	0.8639	0.9663	0.9892	0.9946 (86)
MIT	18.7250	18.9540	19.3328	19.8870	20.4030	20.7749	20.9214	20.8881	20.5876	19.9248	19.2352	18.6865 (87)
Th 2	20.1080	20.1091	20.1102	20.1155	20.1165	20.1211	20.1211	20.1220	20.1194	20.1165	20.1145	20.1124 (88)
util rest of house	0.9925	0.9866	0.9746	0.9367	0.8495	0.6834	0.5064	0.5724	0.8207	0.9571	0.9868	0.9936 (89)
MIT 2	17.9931	18.2219	18.5992	19.1485	19.6428	19.9756	20.0848	20.0660	19.8233	19.1921	18.5069	17.9577 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2266	18.4554	18.8332	19.3841	19.8853	20.2306	20.3516	20.3282	20.0671	19.4258	18.7392	18.1902 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2266	18.4554	18.8332	19.3841	19.8853	20.2306	20.3516	20.3282	20.0671	19.4258	18.7392	18.1902 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9889	0.9811	0.9665	0.9251	0.8407	0.6920	0.5338	0.5965	0.8177	0.9476	0.9817	0.9905 (94)
Useful gains	843.8473	975.2716	1069.6018	1180.1821	1171.2473	971.2785	712.7183	723.2218	887.9945	884.0660	829.0435	806.3670 (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	2885.6830	2804.8074	2548.3890	2152.1821	1678.2277	1147.8224	764.7907	799.9401	1219.1249	1809.5418	2392.3110	2882.9813 (97)
Space heating kWh	1519.1257	1229.4480	1100.2177	699.8400	377.1935	0.0000	0.0000	0.0000	0.0000	688.5540	1125.5526	1545.0011 (98a)
Space heating requirement - total per year (kWh/year)	8284.9327											
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	1519.1257	1229.4480	1100.2177	699.8400	377.1935	0.0000	0.0000	0.0000	0.0000	688.5540	1125.5526	1545.0011 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8284.9327											
Space heating per m2	(98c) / (4) = 38.8053 (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	1916.2451	1508.5334	1547.6535	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6818	0.7614	0.7092	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1306.5804	1148.6050	1097.6706	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1531.0710	1455.8128	1316.7458	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	161.6332	228.5625	162.9919	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.4083	57.1406	40.7480	0.0000	0.0000	0.0000	0.0000 (107)

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Space cooling requirement	138.2969 (107)
Energy for space heating	38.8053 (99)
Energy for space cooling	0.6478 (108)
Total	39.4531 (109)
Fabric Energy Efficiency (DFEE)	39.5 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	213.5000 (1b)	2.7900 (2b)	595.6650 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	213.5000		595.6650 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 595.6650 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0672 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3172 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3172 (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	0.4044	0.3964	0.3885	0.3489	0.3409	0.3013	0.3013	0.2934	0.3172	0.3409	0.3568	0.3727 (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	0.5818	0.5786	0.5755	0.5609	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5637	0.5694 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			27.2700	1.1450	31.2252		(27)
UNHEATED SPACE BELOW			1.8500	0.1300	0.2405		(28a)
Heatloss Floor 1			132.7200	0.1300	17.2536		(28b)
EXTERNAL	123.4000	27.2700	96.1300	0.1800	17.3034		(29a)
HALLWAY	40.3200	2.9100	37.4100	0.1800	6.7338		(29a)
Flat Roof	30.5900		30.5900	0.1100	3.3649		(30)
Total net area of external elements Aum(A, m ²)			328.8800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 79.0314		(33)
Party Wall 1			37.1900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 126.4375 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	15.6700	0.0500	0.7835
E3 Sill	8.4400	0.0500	0.4220
E4 Jamb	34.4800	0.0500	1.7240
E20 Exposed floor (normal)	33.7900	0.3200	10.8128
E21 Exposed floor (inverted)	6.8900	0.3200	2.2048

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E7 Party floor between dwellings (in blocks of flats)	10.4400	0.0700	0.7308	
E14 Flat roof	18.9200	0.0800	1.5136	
E16 Corner (normal)	16.7400	0.0900	1.5066	
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.6400	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	2.6900	0.1200	0.3228	
E18 Party wall between dwellings	11.1600	0.0600	0.6696	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				19.1839 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =		98.2153 (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	114.3556	113.7316	113.1199	110.2468	109.7092	107.2068	107.2068	106.7434	108.1707	109.7092	110.7967	111.9336 (38)
Heat transfer coeff	212.5709	211.9469	211.3352	208.4621	207.9245	205.4221	205.4221	204.9587	206.3860	207.9245	209.0120	210.1489 (39)
Average = Sum(39)m / 12 =												208.4595

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9956	0.9927	0.9899	0.9764	0.9739	0.9622	0.9622	0.9600	0.9667	0.9739	0.9790	0.9843 (40)
HLP (average)												0.9764
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0195 (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	32.3097	31.8299	31.1541	29.9082	28.9753	27.9408	27.3821	28.0531	28.7837	29.8906	31.1621	32.2005	(42b)
Hot water usage for other uses	45.5525	43.8960	42.2396	40.5831	38.9267	37.2702	37.2702	38.9267	40.5831	42.2396	43.8960	45.5525	(42c)
Average daily hot water use (litres/day)													71.3675 (43)
Daily hot water use	77.8622	75.7259	73.3937	70.4913	67.9020	65.2111	64.6523	66.9797	69.3668	72.1301	75.0582	77.7530	(44)
Energy conte	123.3147	107.8326	112.8034	96.4991	91.4091	80.1846	78.1913	82.9349	85.5362	97.8799	106.9341	121.7423	(45)
Energy content (annual)										Total = Sum(45)m =			1185.2624
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	104.8175	91.6578	95.8829	82.0243	77.6977	68.1569	66.4626	70.4947	72.7058	83.1979	90.8940	103.4810	(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	104.8175	91.6578	95.8829	82.0243	77.6977	68.1569	66.4626	70.4947	72.7058	83.1979	90.8940	103.4810	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =			1007.4730 (64)
Electric shower(s)	59.9396	53.4067	58.3181	55.6522	56.6965	54.0830	55.8858	56.6965	55.6522	58.3181	57.2215	59.9396	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			681.8100 (64a)
Heat gains from water heating, kWh/month	41.1893	36.2661	38.5502	34.4191	33.5986	30.5600	30.5871	31.7978	32.0895	35.3790	37.0289	40.8552	(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	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739	150.9739 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	211.8623	234.5619	211.8623	218.9244	211.8623	218.9244	211.8623	211.8623	218.9244	211.8623	218.9244	211.8623 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	383.7015	387.6832	377.6496	356.2893	329.3259	303.9840	287.0541	283.0724	293.1060	314.4662	341.4297	366.7716 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974	38.0974 (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)	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791	-120.7791 (71)
Water heating gains (Table 5)	55.3619	53.9674	51.8148	47.8043	45.1594	42.4444	41.1117	42.7390	44.5687	47.5524	51.4290	54.9128 (72)
Total internal gains	719.2180	744.5046	709.6190	691.3103	654.6397	633.6450	608.3203	605.9659	624.8913	642.1732	680.0753	701.8390 (73)

6. Solar gains

Full SAP Calculation Printout



[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	17.5000	10.6334	0.6300	0.7000	0.7700	56.8698 (74)
East	7.5300	19.6403	0.6300	0.7000	0.7700	45.1975 (76)
South	2.2400	46.7521	0.6300	0.7000	0.7700	32.0052 (78)

Solar gains	134.0725	249.5132	397.0531	584.4611	738.4907	769.8769	726.9709	606.5452	461.1367	290.8194	164.4492	112.2331 (83)
Total gains	853.2905	994.0179	1106.6720	1275.7714	1393.1305	1403.5218	1335.2912	1212.5111	1086.0280	932.9926	844.5246	814.0721 (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, ni1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.2750	35.3789	35.4813	35.9703	36.0633	36.5026	36.5026	36.5852	36.3321	36.0633	35.8757	35.6816
alpha	3.3517	3.3586	3.3654	3.3980	3.4042	3.4335	3.4335	3.4390	3.4221	3.4042	3.3917	3.3788
util living area	0.9936	0.9887	0.9790	0.9487	0.8802	0.7485	0.6073	0.6693	0.8655	0.9667	0.9892	0.9946 (86)
MIT	18.6655	18.8991	19.2855	19.8596	20.3845	20.7693	20.9188	20.8853	20.5779	19.9035	19.2024	18.6409 (87)
Th 2	20.0870	20.0894	20.0918	20.1030	20.1052	20.1150	20.1150	20.1168	20.1112	20.1052	20.1009	20.0964 (88)
util rest of house	0.9924	0.9866	0.9748	0.9375	0.8516	0.6855	0.5086	0.5742	0.8224	0.9574	0.9868	0.9936 (89)
MIT 2	17.9193	18.1535	18.5394	19.1127	19.6169	19.9659	20.0775	20.0595	19.8082	19.1630	18.4647	17.9013 (90)
Living area fraction	flA = Living area / (4) =											
MIT	18.1573	18.3913	18.7774	19.3509	19.8617	20.2222	20.3458	20.3229	20.0537	19.3992	18.7000	18.1372 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1573	18.3913	18.7774	19.3509	19.8617	20.2222	20.3458	20.3229	20.0537	19.3992	18.7000	18.1372 (93)

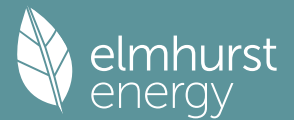
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9888	0.9810	0.9666	0.9257	0.8425	0.6939	0.5360	0.5983	0.8191	0.9478	0.9816	0.9904 (94)
Useful gains	843.7174	975.1797	1069.7069	1180.9638	1173.6579	973.9087	715.6706	725.3899	889.5384	884.3015	828.9852	806.2721 (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	2945.6616	2859.4449	2594.6368	2178.6195	1697.0253	1154.9184	769.4765	804.0343	1228.7665	1829.5695	2424.5399	2928.8933 (97)
Space heating kWh	1563.8464	1266.2262	1134.5479	718.3121	389.3853	0.0000	0.0000	0.0000	0.0000	703.2794	1148.7994	1579.2302 (98a)
Space heating requirement - total per year (kWh/year)	8503.6268											
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	1563.8464	1266.2262	1134.5479	718.3121	389.3853	0.0000	0.0000	0.0000	0.0000	703.2794	1148.7994	1579.2302 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8503.6268											
Space heating per m2	(98c) / (4) = 39.8296 (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	1930.9680	1520.1238	1557.6863	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6777	0.7574	0.7058	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1308.6271	1151.3754	1099.3664	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1531.0710	1455.8128	1316.7458	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	160.1596	226.5014	161.7302	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	40.0399	56.6254	40.4326	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	137.0978 (107)											
Energy for space heating	39.8296 (99)											
Energy for space cooling	0.6421 (108)											
Total	40.4718 (109)											
Fabric Energy Efficiency (TFEE)	40.5 (109)											

Predicted Energy Assessment

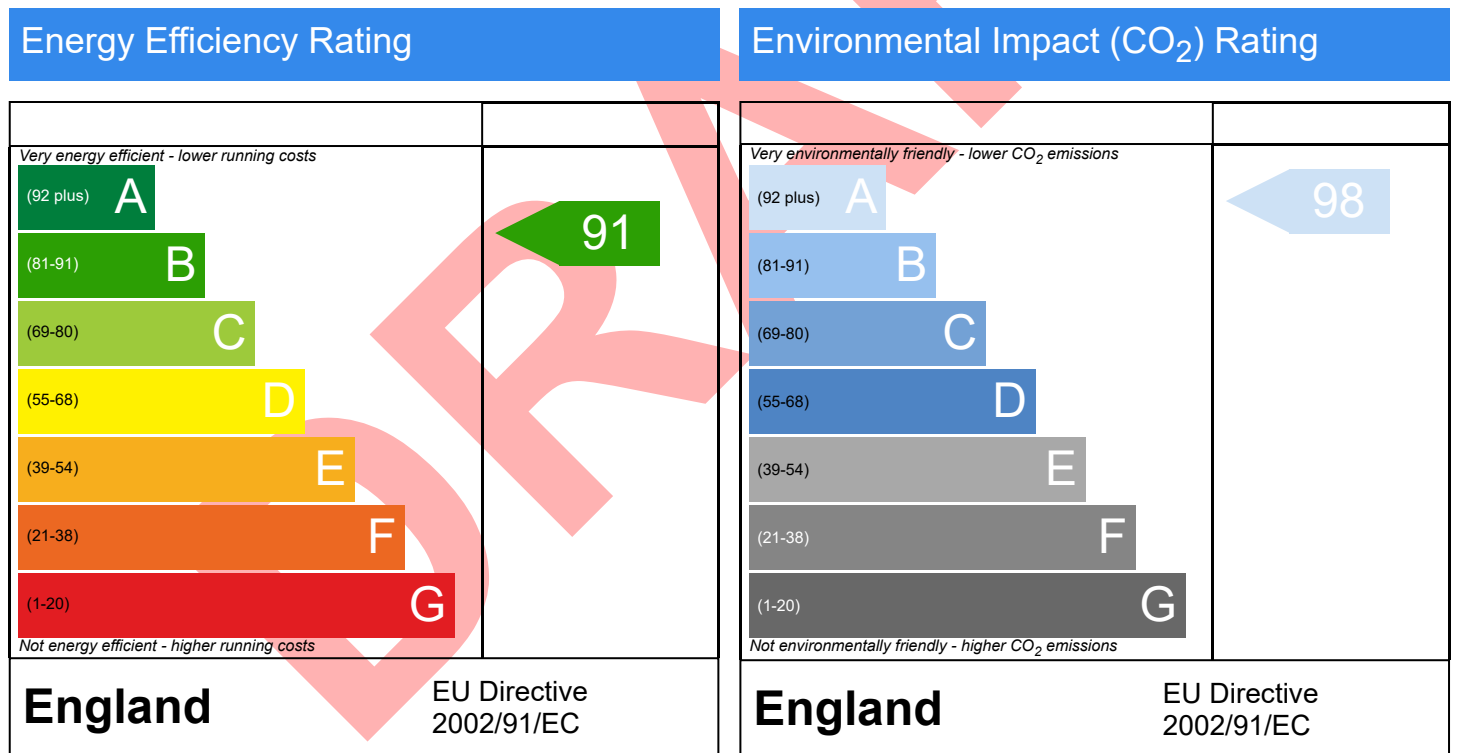


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Semi-Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 213.5 m²
 DRRN:

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.

Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Semi-Detached
Floor Area [m ²]	214

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

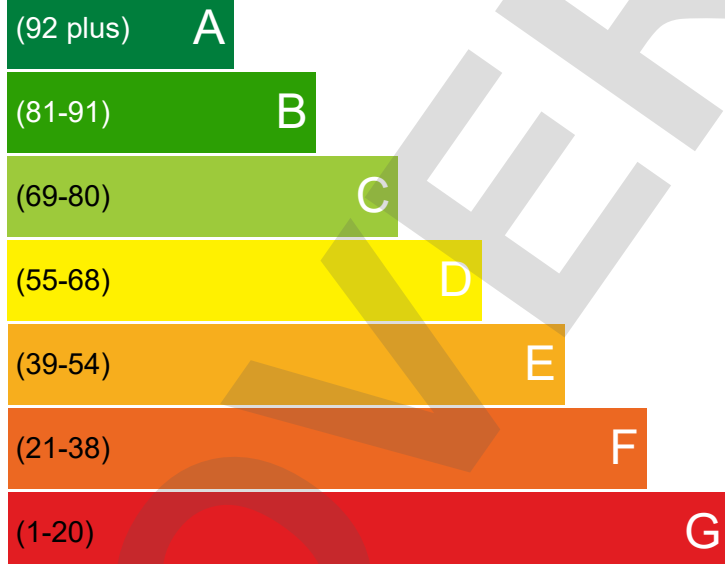
Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL



Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.13 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excellent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 17 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.3** per year

With the recommended measures the potential CO emissions could be: **0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£484

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:04

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Semi-detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	181 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 4 - Boiler
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	10.0 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	12.85 kgCO ₂ /m ²		FAIL
1b Target primary energy rate and dwelling primary energy			
Target primary energy	52.57 kWh _{PE} /m ²		
Dwelling primary energy	71.43 kWh _{PE} /m ²		FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	37.2 kWh/m ²		
Dwelling fabric energy efficiency	35.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	WEST (1.2)	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)	89.52	0.18
Sheltered wall: Walls (2)	36.26	0.18
Party wall: Party Wall (1)	32.17	0 (!)
Exposed roof: Roof (1)	122.44	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
WEST, Windows	7.43	West	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	East	N/A	1.2
SOUTH, Windows	2.03	South	0.7	1.2
NORTH, Windows	13.62	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

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	3 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

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

Efficiency	84.2%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Regular boiler
Manufacturer	Vaillant
Model	ecoFIT pure 630
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	500 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

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

Efficiency	
Manufacturer	
Model	

6 Controls

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

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

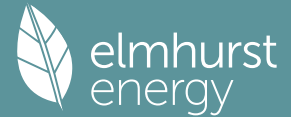
Manufacturer	
Model	

7 Lighting

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 4 - Boiler	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	85 B	DER	12.85	TER	10.00
Environmental	86 B	% DER < TER			-28.50
CO ₂ Emissions (t/year)	2.19	DFEE	35.79	TFEE	37.16
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	-35.88	DPER	71.43	TPER	52.57

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	Flat, Semi-Detached	
Position of Flat	Mid-floor flat	
Which Floor	1	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	180.98 m ²	2.79 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

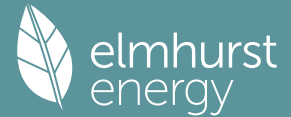
8.0 Living Area	39.60	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	112.60	89.52	0.00	None	23.08	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	39.17	36.26	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	32.17	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	122.44	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



10.1 Party Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	58.54

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	180.98

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
WEST	Windows	EXTERNAL	West	7.43	0
ENTRANCE DOOR	Entrance Door	HALLWAY	East	2.91	0
SOUTH	Windows	EXTERNAL	South	2.03	0
NORTH	Windows	EXTERNAL	North	13.62	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	13.30	0.30	0.30	No
E3 Sill	Independently assessed	6.75	0.04	0.04	No
E4 Jamb	Independently assessed	33.00	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	54.38	0.07	0.07	No
E14 Flat roof	Independently assessed	40.94	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.74	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	19.53	-0.09	-0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	11.53	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	2.83	0.12	0.12	No
E18 Party wall between dwellings	Independently assessed	11.16	0.06	0.06	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m²/(h.m²) @ 50 Pa

Property Tested?

Test Method

As Built AP₅₀ m²/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

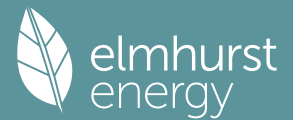
MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

20.0 Fans, Open Fireplaces, Flues

Summary for Input Data



21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

SAP Code

In Winter

In Summer

Model Name

Manufacturer

System Type

Controls SAP Code

Delayed Start Stat

Burner Control

HETAS approved System

Oil Pump Inside

FI Case

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heating Pump Age

Heat Emitter

Underfloor Heating

Flow Temperature

Boiler Interlock

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

26.0 Heat Networks

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

Summer Immersion

Summary for Input Data



Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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
Independent Time Control	Yes
Insulation Type	Foam
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

Thermal Store	None
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Recommendations

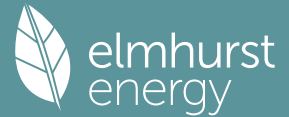
Lower cost measures

None

Further measures to achieve even higher standards

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

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 4 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	85 B	DER	12.85	TER	10.00
Environmental	86 B	% DER < TER			-28.50
CO ₂ Emissions (t/year)	2.19	DFEE	35.79	TFEE	37.16
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	-35.88	DPER	71.43	TPER	52.57
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	180.9800 (1b)	2.7900 (2b)	504.9342 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.9800		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 504.9342 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			23.0800	1.1450	26.4275		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	112.6000	23.0800	89.5200	0.1800	16.1136	70.0000	6266.4000 (29a)
HALLWAY	39.1700	2.9100	36.2600	0.1700	6.1642	70.0000	2538.2000 (29a)

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Flat Roof	122.4400	122.4400	0.1100	13.4684	9.0000	1101.9600 (30)
Total net area of external elements Aum(A, m2)		274.2100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	65.6657		(33)
Party Wall 1		32.1700	0.0000	0.0000	180.0000	5790.6000 (32)
Party Floor 1		180.9800			40.0000	7239.2000 (32d)
Party Ceiling 1		58.5400			30.0000	1756.2000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24692.5600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 136.4381 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.3000	0.3000	3.9900
E3 Sill	6.7500	0.0400	0.2700
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	54.3800	0.0700	3.8066
E14 Flat roof	40.9400	0.0400	1.6376
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	19.5300	-0.0900	-1.7577
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1123 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 77.7780 (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	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141 (38)
Average = Sum(39)m / 12 =	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

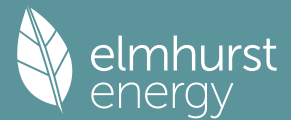
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9771 (42)
Hot water usage for mixer showers	74.1360	73.0219	71.3984	68.2922	65.9998	63.4434	61.9904	63.6016	65.3678	68.1126	71.2855	73.8520	73.8520 (42a)
Hot water usage for baths	33.6886	33.1883	32.4837	31.1846	30.2119	29.1333	28.5507	29.2503	30.0121	31.1662	32.4920	33.5747	33.5747 (42b)
Hot water usage for other uses	47.4931	45.7661	44.0391	42.3121	40.5851	38.8580	38.8580	40.5851	42.3121	44.0391	45.7661	47.4931	47.4931 (42c)
Average daily hot water use (litres/day)													142.7612 (43)
Daily hot water use	155.3178	151.9763	147.9212	141.7889	136.7968	131.4347	129.3991	133.4369	137.6919	143.3179	149.5437	154.9198	154.9198 (44)
Energy conte	245.9854	216.4122	227.3494	194.1019	184.1547	161.6143	156.4969	165.2228	169.7879	194.4810	213.0524	242.5670	242.5670 (45)
Energy content (annual)										Total = Sum(45)m =			2371.2260
Distribution loss (46)m = 0.15 x (45)m	36.8978	32.4618	34.1024	29.1153	27.6232	24.2421	23.4745	24.7834	25.4682	29.1721	31.9579	36.3851	36.3851 (46)
Water storage loss:													
Store volume													500.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0115 (51)
Volume factor from Table 2a													0.6214 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.9376 (55)
Total storage loss	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650 (56)
If cylinder contains dedicated solar storage	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650 (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	329.3128	291.6757	310.6768	274.7413	267.4822	242.2538	239.8244	248.5502	250.4273	277.8084	293.6919	325.8944	325.8944 (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	329.3128	291.6757	310.6768	274.7413	267.4822	242.2538	239.8244	248.5502	250.4273	277.8084	293.6919	325.8944	325.8944 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =			3352.3392 (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	148.4521	132.1678	142.2556	129.0504	127.8934	118.2483	118.6972	121.5985	120.9660	131.3269	135.3515	147.3155	147.3155 (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
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(66)m	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	194.7513	215.6175	194.7513	201.2430	194.7513	201.2430	194.7513	194.7513	201.2430	194.7513	201.2430	194.7513	201.2430	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5890	356.2478	347.0278	327.3996	302.6224	279.3354	263.7782	260.1195	269.3394	288.9677	313.7448	337.0319	337.0319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	(71)
Water heating gains (Table 5)	199.5324	196.6783	191.2038	179.2367	171.8997	164.2338	159.5392	163.4389	168.0084	176.5146	187.9882	198.0047	198.0047	(72)
Total internal gains	817.5292	839.2001	803.6394	778.5357	739.9299	712.4686	685.7252	685.9661	706.2473	730.8901	773.6325	800.4443	800.4443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610	(74)						
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047	(78)						
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972	(80)						
Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355	(83)
Total gains	935.3921	1058.5290	1151.5539	1287.3334	1378.9958	1376.8676	1313.8458	1212.6328	1109.3667	986.3326	918.2221	899.0798	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, ni1,m (see Table 9a)	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	21.0000 (85)
tau	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	
alpha	0.9886	0.9808	0.9653	0.9202	0.8248	0.6665	0.5150	0.5716	0.7941	0.9417	0.9805	0.9902	(86)
util living area	19.5983	19.7555	20.0034	20.3474	20.6497	20.8349	20.8955	20.8837	20.7470	20.3609	19.9176	19.5605	(87)
MIT	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	(88)
Th 2	0.9865	0.9773	0.9586	0.9042	0.7894	0.6020	0.4279	0.4833	0.7410	0.9268	0.9763	0.9884	(89)
util rest of house	18.5029	18.7029	19.0172	19.4462	19.8069	20.0061	20.0594	20.0514	19.9222	19.4692	18.9108	18.4547	(90)
MIT 2	18.7426	18.9333	19.2330	19.6434	19.9913	20.1875	20.2424	20.2335	20.1027	19.6643	19.1311	18.6966	(92)
Living area fraction	18.7426	18.9333	19.2330	19.6434	19.9913	20.1875	20.2424	20.2335	20.1027	19.6643	19.1311	18.6966	(93)
MIT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Temperature adjustment	18.7426	18.9333	19.2330	19.6434	19.9913	20.1875	20.2424	20.2335	20.1027	19.6643	19.1311	18.6966	(93)
adjusted MIT	18.7426	18.9333	19.2330	19.6434	19.9913	20.1875	20.2424	20.2335	20.1027	19.6643	19.1311	18.6966	(93)

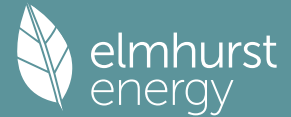
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9704	0.9491	0.8919	0.7805	0.6030	0.4352	0.4898	0.7357	0.9153	0.9693	0.9841	(94)
Useful gains	918.2539	1027.1464	1092.8895	1148.2114	1076.2724	830.1915	571.7407	593.9192	816.1229	902.8274	889.9972	884.7666	(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	2326.5848	2260.6466	2051.1821	1730.6742	1335.6636	900.0988	586.7566	617.5525	966.9885	1460.1920	1938.1079	2335.2901	(97)
Space heating kWh	1047.7982	828.9122	712.9697	419.3732	192.9871	0.0000	0.0000	0.0000	0.0000	414.6793	754.6397	1079.1895	(98a)
Space heating requirement - total per year (kWh/year)												5450.5489	
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	1047.7982	828.9122	712.9697	419.3732	192.9871	0.0000	0.0000	0.0000	0.0000	414.6793	754.6397	1079.1895	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5450.5489	
Space heating per m2										(98c) / (4) =		30.1169	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												84.2000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	1047.7982	828.9122	712.9697	419.3732	192.9871	0.0000	0.0000	0.0000	0.0000	414.6793	754.6397	1079.1895	(98)
Space heating efficiency (main heating system 1)	84.2000	84.2000	84.2000	84.2000	84.2000	0.0000	0.0000	0.0000	0.0000	84.2000	84.2000	84.2000	(210)

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Space heating fuel (main heating system)	1244.4160	984.4562	846.7574	498.0679	229.2008	0.0000	0.0000	0.0000	0.0000	492.4932	896.2467	1281.6977	(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	329.3128	291.6757	310.6768	274.7413	267.4822	242.2538	239.8244	248.5502	250.4273	277.8084	293.6919	325.8944	(64)
Efficiency of water heater												80.2000	(216)
(217)m	81.8688	81.6685	81.2620	80.4064	78.7411	75.2000	75.2000	75.2000	75.2000	80.3573	81.4812	81.9372	(217)
Fuel for water heating, kWh/month	402.2444	357.1460	382.3149	341.6908	339.6981	322.1460	318.9154	330.5189	333.0150	345.7167	360.4414	397.7369	(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	20.4886	18.5058	20.4886	19.8277	20.4886	19.8277	20.4886	20.4886	19.8277	20.4886	19.8277	20.4886	(231)
Lighting	37.6533	30.2069	27.1980	19.9264	15.3917	12.5752	14.0408	18.2508	23.7066	31.1036	35.1314	38.6998	(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												6473.3360	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.2000	
Water heating fuel used												4231.5845	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)													
mechanical ventilation fans (SFP = 0.2520)												155.2370	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												241.2370	(231)
Electricity for lighting (calculated in Appendix L)												303.8841	(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												11250.0414	(238)

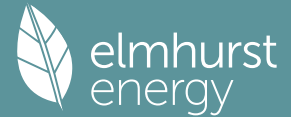
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6473.3360	0.2100	1359.4005	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	4231.5845	0.2100	888.6327	(264)
Space and water heating			2248.0333	(265)
Pumps, fans and electric keep-hot	241.2370	0.1387	33.4625	(267)
Energy for lighting	303.8841	0.1443	43.8599	(268)
Total CO2, kg/year			2325.3557	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.8500	(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	6473.3360	1.1300	7314.8696	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	4231.5845	1.1300	4781.6904	(278)
Space and water heating			12096.5601	(279)
Pumps, fans and electric keep-hot	241.2370	1.5128	364.9433	(281)
Energy for lighting	303.8841	1.5338	466.1075	(282)
Total Primary energy kWh/year			12927.6109	(286)
Dwelling Primary energy Rate (DPER)			71.4300	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	x	Storey height (m)	=	Volume (m ³)
Ground floor	180.9800 (1b)		2.7900 (2b)		504.9342 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.9800				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 504.9342 (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	4 * 10 =	40.0000 (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 40.0000 / (5) = 0.0792 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3292 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3292 (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												
Effective ac	0.4198	0.4115	0.4033	0.3621	0.3539	0.3128	0.3128	0.3045	0.3292	0.3539	0.3704	0.3868 (22b)
	0.5881	0.5847	0.5813	0.5656	0.5626	0.5489	0.5489	0.5464	0.5542	0.5626	0.5686	0.5748 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			23.0800	1.1450	26.4275		(27)
EXTERNAL	112.6000	23.0800	89.5200	0.1800	16.1136		(29a)
HALLWAY	39.1700	2.9100	36.2600	0.1800	6.5268		(29a)
Flat Roof	122.4400		122.4400	0.1100	13.4684		(30)
Total net area of external elements Aum(A, m ²)			274.2100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 65.4463		(33)
Party Wall 1			32.1700	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 139.6727 (35)

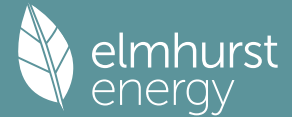
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.0500	0.6650
E3 Sill	6.7500	0.0500	0.3375
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	54.3800	0.0700	3.8066
E14 Flat roof	40.9400	0.0800	3.2752
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	19.5300	-0.0900	-1.7577
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	11.1600	0.0600	0.6696
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.4924 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 75.9387 (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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(38)m	97.9935	97.4235	96.8647	94.2404	93.7494	91.4637	91.4637	91.0404	92.3441	93.7494	94.7427	95.7812	(38)
Heat transfer coeff	173.9322	173.3622	172.8034	170.1791	169.6881	167.4024	167.4024	166.9791	168.2828	169.6881	170.6814	171.7198	(39)
Average = Sum(39)m / 12 =												170.1767	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9611	0.9579	0.9548	0.9403	0.9376	0.9250	0.9250	0.9226	0.9298	0.9376	0.9431	0.9488	(40)
HLP (average)												0.9403	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9771	(42)
Hot water usage for mixer showers													73.8520	(42a)
Hot water usage for baths													31.8960	(42b)
Hot water usage for other uses													45.1185	(42c)
Average daily hot water use (litres/day)													139.0406	(43)
Daily hot water use														
Energy conte	151.2587	148.0286	144.0951	138.1140	133.2569	128.0352	126.0286	129.9452	134.0757	139.5576	145.6308	150.8664	(44)	
Energy content (annual)	239.5568	210.7907	221.4688	189.0712	179.3894	157.4342	152.4207	160.8992	165.3287	189.3783	207.4778	236.2204	(45)	
Distribution loss (46)m = 0.15 x (45)m													2309.4362	
Water storage loss:														
Store volume													500.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													2.9009	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.5665	(55)
Total storage loss														
If cylinder contains dedicated solar storage														
Primary loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(56)	
Combi loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(57)	
Total heat required for water heating calculated for each month	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)	
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	(61)	
PV diverter	311.3799	275.6632	293.2919	258.5774	251.2125	226.9404	224.2438	232.7224	234.8350	261.2015	276.9840	308.0435	(62)	
Solar input	-33.8919	-29.9743	-31.3873	-25.9900	-24.2217	-20.7267	-19.4280	-20.6597	-21.4446	-25.2809	-28.6401	-33.2643	(63a)	
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	(63b)	
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	(63c)	
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	(63d)	
Electric shower(s)	277.4880	245.6889	261.9046	232.5875	226.9908	206.2137	204.8159	212.0627	213.3903	235.9206	248.3439	274.7792	(64)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												2840.1860	(64)	
Heat gains from water heating, kWh/month														
Total per year (kWh/year)	137.1111	121.9859	131.0969	118.4712	117.1055	107.9519	108.1384	110.9575	110.5768	120.4268	124.5913	136.0018	(65)	

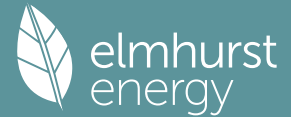
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	194.7513	215.6175	194.7513	201.2430	194.7513	201.2430	194.7513	194.7513	201.2430	194.7513	201.2430	194.7513	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5890	356.2478	347.0278	327.3996	302.6224	279.3354	263.7782	260.1195	269.3394	288.9677	313.7448	337.0319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	(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)	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	(71)
Water heating gains (Table 5)	184.2891	181.5266	176.2055	164.5433	157.3998	149.9331	145.3473	149.1364	153.5789	161.8640	173.0435	182.7981	(72)
Total internal gains	802.2859	824.0484	788.6410	763.8423	725.4300	698.1680	671.5333	671.6636	691.8178	716.2394	758.6879	785.2377	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610 (74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972 (80)

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Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	920.1488	1043.3773	1136.5556	1272.6400	1364.4959	1362.5670	1299.6538	1198.3304	1094.9372	971.6820	903.2774	883.8732 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.3701	40.5028	40.6338	41.2604	41.3798	41.9448	41.9448	42.0511	41.7253	41.3798	41.1390	40.8902	
alpha	3.6913	3.7002	3.7089	3.7507	3.7587	3.7963	3.7963	3.8034	3.7817	3.7587	3.7426	3.7260	
util living area	0.9901	0.9834	0.9702	0.9301	0.8431	0.6877	0.5363	0.5929	0.8134	0.9493	0.9831	0.9915 (86)	
MIT	19.0853	19.3032	19.6500	20.1539	20.5864	20.8696	20.9616	20.9440	20.7378	20.1854	19.5667	19.0640 (87)	
Th 2	20.1159	20.1186	20.1212	20.1334	20.1357	20.1463	20.1463	20.1483	20.1422	20.1357	20.1310	20.1262 (88)	
util rest of house	0.9882	0.9802	0.9641	0.9150	0.8083	0.6212	0.4438	0.5002	0.7606	0.9356	0.9793	0.9899 (89)	
MIT 2	17.8463	18.1256	18.5679	19.2069	19.7280	20.0442	20.1253	20.1153	19.9134	19.2557	18.4713	17.8257 (90)	
Living area fraction	18.1174	18.3833	18.8046	19.4141	19.9159	20.2248	20.3083	20.2967	20.0938	19.4592	18.7110	0.2188 (91)	
MIT	18.1174	18.3833	18.8046	19.4141	19.9159	20.2248	20.3083	20.2967	20.0938	19.4592	18.7110	18.0966 (92)	
Temperature adjustment	18.1174	18.3833	18.8046	19.4141	19.9159	20.2248	20.3083	20.2967	20.0938	19.4592	18.7110	0.0000	
adjusted MIT	18.1174	18.3833	18.8046	19.4141	19.9159	20.2248	20.3083	20.2967	20.0938	19.4592	18.7110	18.0966 (93)	

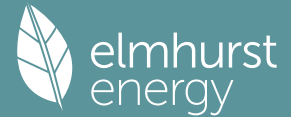
8. Space heating requirement

Utilisation	0.9820	0.9714	0.9519	0.8997	0.7983	0.6278	0.4621	0.5173	0.7572	0.9216	0.9705	0.9843 (94)
Useful gains	903.5542	1013.4981	1081.8660	1144.9576	1089.2188	855.4345	600.5749	619.8785	829.1395	895.4907	876.6661	869.9968 (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	2403.2961	2337.4923	2126.2842	1789.2782	1394.1323	941.6070	620.7786	650.6606	1008.6508	1503.2928	1981.7852	2386.3292 (97)
Space heating kWh	1115.8079	889.7241	777.0471	463.9109	226.8556	0.0000	0.0000	0.0000	0.0000	452.2048	795.6858	1128.1513 (98a)
Space heating requirement - 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	5849.3875
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)	1115.8079	889.7241	777.0471	463.9109	226.8556	0.0000	0.0000	0.0000	0.0000	452.2048	795.6858	1128.1513 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5849.3875
Space heating per m2												(98c) / (4) = 32.3206 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1115.8079	889.7241	777.0471	463.9109	226.8556	0.0000	0.0000	0.0000	0.0000	452.2048	795.6858	1128.1513 (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)	1208.8927	963.9481	841.8712	502.6120	245.7807	0.0000	0.0000	0.0000	0.0000	489.9293	862.0647	1222.2657 (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	277.4880	245.6889	261.9046	232.5875	226.9908	206.2137	204.8159	212.0627	213.3903	235.9206	248.3439	274.7792 (64)	
Efficiency of water heater (217)m	86.8492	86.6845	86.3451	85.5770	84.0584	79.8000	79.8000	79.8000	79.8000	85.4942	86.4800	79.8000 (216)	
Fuel for water heating, kWh/month	319.5054	283.4289	303.3228	271.7874	270.0393	258.4132	256.6615	265.7427	267.4064	275.9492	287.1693	316.2714 (219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041 (231)	
Lighting	40.4655	32.4629	29.2292	21.4146	16.5412	13.5143	15.0895	19.6139	25.4765	33.4265	37.7552	41.5901 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-45.1957	-65.2485	-95.9653	-110.4077	-121.0948	-113.6451	-112.1544	-104.8485	-92.3441	-75.6634	-50.1966	-38.8902 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													

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(233b)m	-21.0519	-44.7441	-89.8283	-136.2694	-181.5646	-183.0414	-180.9829	-152.6761	-111.1039	-64.5362	-28.2743	-16.6200	(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												6337.3646	(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												3375.6975	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												326.5795	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2236.3475	(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												7889.2941	(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	6337.3646	0.2100	1330.8466 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3375.6975	0.2100	708.8965 (264)
Space and water heating			2039.7430 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	326.5795	0.1443	47.1355 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1025.6544	0.1341	-137.5667
PV Unit electricity exported	-1210.6931	0.1256	-152.0502
Total			-289.6169 (269)
Total CO2, kg/year			1809.1909 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0000 (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	6337.3646	1.1300	7161.2220 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3375.6975	1.1300	3814.5382 (278)
Space and water heating			10975.7601 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	326.5795	1.5338	500.9185 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1025.6544	1.4957	-1534.0516
PV Unit electricity exported	-1210.6931	0.4610	-558.1095
Total			-2092.1611 (283)
Total Primary energy kWh/year			9514.6184 (286)
Target Primary Energy Rate (TPER)			52.5700 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 4 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	85 B	DER	12.85	TER	10.00
Environmental	86 B	% DER < TER			-28.50
CO ₂ Emissions (t/year)	2.19	DFEE	35.79	TFEE	37.16
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	-35.88	DPER	71.43	TPER	52.57
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	180.9800 (1b)	2.7900 (2b)	504.9342 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.9800		504.9342 (5)
Dwelling volume			

2. Ventilation rate

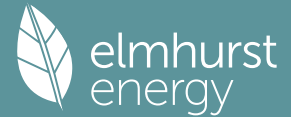
	Value	Reference
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0792 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.2292	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2292 (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	0.2923	0.2865	0.2808	0.2521	0.2464	0.2178	0.2178	0.2120	0.2292	0.2464	0.2579	0.2693 (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	0.5427	0.5410	0.5394	0.5318	0.5304	0.5237	0.5237	0.5225	0.5263	0.5304	0.5332	0.5363 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			23.0800	1.1450	26.4275		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	112.6000	23.0800	89.5200	0.1800	16.1136	70.0000	6266.4000 (29a)
HALLWAY	39.1700	2.9100	36.2600	0.1700	6.1642	70.0000	2538.2000 (29a)
Flat Roof	122.4400		122.4400	0.1100	13.4684	9.0000	1101.9600 (30)
Total net area of external elements A _{um} (A, m ²)			274.2100				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	65.6657		(33)
Party Wall 1	32.1700	0.0000	0.0000	180.0000 5790.6000 (32)
Party Floor 1	180.9800			40.0000 7239.2000 (32d)
Party Ceiling 1	58.5400			40.0000 2341.6000 (32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25277.9600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		139.6727	(35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.3000	3.9900
E3 Sill	6.7500	0.0400	0.2700
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	54.3800	0.0700	3.8066
E14 Flat roof	40.9400	0.0400	1.6376
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	19.5300	-0.0900	-1.7577
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.1123	(36)
Point Thermal bridges		0.0000	(36a) =
Total fabric heat loss	(33) + (36) + (36a) =	77.7780	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	90.4302	90.1538	89.8830	88.6108	88.3728	87.2648	87.2648	87.0596	87.6916	88.3728	88.8543	89.3577	(38)
Average = Sum(39)m / 12 =	168.2081	167.9318	167.6610	166.3888	166.1508	165.0427	165.0427	164.8375	165.4695	166.1508	166.6323	167.1357	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9294	0.9279	0.9264	0.9194	0.9181	0.9119	0.9119	0.9108	0.9143	0.9181	0.9207	0.9235	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

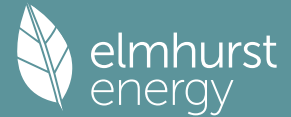
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9771	(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	32.0041	31.5288	30.8595	29.6254	28.7013	27.6766	27.1231	27.7878	28.5115	29.6079	30.8674	31.8960	31.8960	(42b)
Hot water usage for other uses	45.1185	43.4778	41.8371	40.1965	38.5558	36.9151	36.9151	38.5558	40.1965	41.8371	43.4778	45.1185	45.1185	(42c)
Average daily hot water use (litres/day)													70.6897	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	77.1226	75.0067	72.6967	69.8219	67.2571	64.5917	64.0382	66.3436	68.7079	71.4450	74.3453	77.0144	(44)	
Distribution loss (46)m = 0.15 x (45)m	122.1434	106.8085	111.7320	95.5826	90.5410	79.4231	77.4487	82.1472	84.7237	96.9502	105.9184	120.5860	(45)	
Total = Sum(45)m =													1174.0049	
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	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	0.0000	(61)
Total heat required for water heating calculated for each month	103.8219	90.7872	94.9722	81.2452	76.9598	67.5096	65.8314	69.8251	72.0152	82.4077	90.0307	102.4981	(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	(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	103.8219	90.7872	94.9722	81.2452	76.9598	67.5096	65.8314	69.8251	72.0152	82.4077	90.0307	102.4981	(64)	
Total per year (kWh/year)													997.9042	(64)
Electric shower(s)	59.3706	52.8997	57.7645	55.1239	56.1583	53.5696	55.3552	56.1583	55.1239	57.7645	56.6783	59.3706	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													675.3373	(64a)
Heat gains from water heating, kWh/month	40.7981	35.9217	38.1842	34.0923	33.2795	30.2698	30.2967	31.4959	31.7848	35.0430	36.6772	40.4672	(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	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	194.7513	215.6175	194.7513	201.2430	194.7513	201.2430	194.7513	194.7513	201.2430	194.7513	201.2430	194.7513	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5890	356.2478	347.0278	327.3996	302.6224	279.3354	263.7782	260.1195	269.3394	288.9677	313.7448	337.0319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	(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)

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Losses e.g. evaporation (negative values) (Table 5)	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	(71)
Water heating gains (Table 5)	54.8362	53.4550	51.3228	47.3504	44.7305	42.0414	40.7213	42.3331	44.1455	47.1009	50.9406	54.3914	(72)
Total internal gains	669.8330	692.9767	660.7584	643.6494	609.7607	590.2762	566.9073	564.8604	582.3844	598.4763	633.5849	653.8310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610	(74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047	(78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972	(80)

Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355	(83)
Total gains	787.6959	912.3056	1008.6729	1152.4471	1248.8266	1254.6752	1195.0278	1091.5271	985.5038	853.9189	778.1745	752.4665	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	41.7438	41.8125	41.8801	42.2003	42.2607	42.5445	42.5445	42.5974	42.4347	42.2607	42.1386	42.0117		
alpha	3.7829	3.7875	3.7920	3.8134	3.8174	3.8363	3.8363	3.8398	3.8290	3.8174	3.8092	3.8008		
util living area	0.9941	0.9891	0.9789	0.9453	0.8674	0.7201	0.5689	0.6315	0.8469	0.9645	0.9895	0.9951	(86)	
MIT	19.0358	19.2528	19.5991	20.1016	20.5506	20.8511	20.9549	20.9327	20.7009	20.1202	19.4971	19.0002	(87)	
Th 2	20.1426	20.1438	20.1451	20.1511	20.1522	20.1574	20.1574	20.1583	20.1554	20.1522	20.1499	20.1476	(88)	
util rest of house	0.9930	0.9870	0.9744	0.9331	0.8362	0.6553	0.4744	0.5378	0.7994	0.9543	0.9871	0.9941	(89)	
MIT 2	18.3173	18.5342	18.8789	19.3763	19.8019	20.0647	20.1377	20.1266	19.9468	19.4010	18.7829	18.2854	(90)	
Living area fraction	fLA = Living area / (4) =												0.2188	(91)
MIT	18.4745	18.6915	19.0365	19.5350	19.9657	20.2368	20.3165	20.3030	20.1118	19.5584	18.9392	18.4418	(92)	
Temperature adjustment													0.0000	
adjusted MIT	18.4745	18.6915	19.0365	19.5350	19.9657	20.2368	20.3165	20.3030	20.1118	19.5584	18.9392	18.4418	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Utilisation	0.9898	0.9820	0.9669	0.9222	0.8283	0.6619	0.4931	0.5550	0.7966	0.9451	0.9823	0.9914	(94)		
Useful gains	779.6644	895.8887	975.2683	1062.7332	1034.4009	830.4667	589.3111	605.7498	785.0640	807.0496	764.3941	745.9764	(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	2384.2697	2316.0279	2101.8807	1769.5494	1373.3517	930.3138	613.3792	643.3602	994.7726	1488.4433	1972.7852	2380.3137	(97)		
Space heating kWh	1193.8263	954.3335	838.1996	508.9076	252.1794	0.0000	0.0000	0.0000	0.0000	506.9569	870.0416	1215.9469	(98a)		
Space heating requirement - total per year (kWh/year)													6340.3919		
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	1193.8263	954.3335	838.1996	508.9076	252.1794	0.0000	0.0000	0.0000	0.0000	506.9569	870.0416	1215.9469	(98c)		
Space heating requirement after solar contribution - total per year (kWh/year)													6340.3919		
Space heating per m2													(98c) / (4) =	35.0337	(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	1551.4017	1221.3162	1252.7653	0.0000	0.0000	0.0000	0.0000		
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7406	0.8179	0.7709	0.0000	0.0000	0.0000	0.0000		
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1149.0101	998.9301	965.7922	0.0000	0.0000	0.0000	0.0000		
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1367.9518	1302.3810	1185.4703	0.0000	0.0000	0.0000	0.0000		
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	157.6380	225.7675	163.4405	0.0000	0.0000	0.0000	0.0000		
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		
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	39.4095	56.4419	40.8601	0.0000	0.0000	0.0000	0.0000		
Space cooling requirement													136.7115	(107)
Energy for space heating													35.0337	(99)
Energy for space cooling													0.7554	(108)
Total													35.7891	(109)

Fabric Energy Efficiency (DFEE)

35.8 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	180.9800 (1b)	x 2.7900 (2b)	= 504.9342 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	504.9342 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0792 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3292 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3292 (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	0.4198	0.4115	0.4033	0.3621	0.3539	0.3128	0.3128	0.3045	0.3292	0.3539	0.3704	0.3868 (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	0.5881	0.5847	0.5813	0.5656	0.5626	0.5489	0.5489	0.5464	0.5542	0.5626	0.5686	0.5748 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			23.0800	1.1450	26.4275		(27)
EXTERNAL	112.6000	23.0800	89.5200	0.1800	16.1136		(29a)
HALLWAY	39.1700	2.9100	36.2600	0.1800	6.5268		(29a)
Flat Roof	122.4400		122.4400	0.1100	13.4684		(30)
Total net area of external elements Aum(A, m ²)			274.2100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	65.4463	(33)
Party Wall 1			32.1700	0.0000	0.0000		(32)

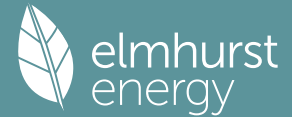
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

139.6727 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.0500	0.6650
E3 Sill	6.7500	0.0500	0.3375
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	54.3800	0.0700	3.8066
E14 Flat roof	40.9400	0.0800	3.2752
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	19.5300	-0.0900	-1.7577
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	11.1600	0.0600	0.6696
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.4924 (36)

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Point Thermal bridges
 Total fabric heat loss (33) + (36) + (36a) = 0.0000
 75.9387 (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	97.9935	97.4235	96.8647	94.2404	93.7494	91.4637	91.4637	91.0404	92.3441	93.7494	94.7427	95.7812 (38)
Heat transfer coeff	173.9322	173.3622	172.8034	170.1791	169.6881	167.4024	167.4024	166.9791	168.2828	169.6881	170.6814	171.7198 (39)
Average = Sum(39)m / 12 =												170.1767

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9611	0.9579	0.9548	0.9403	0.9376	0.9250	0.9250	0.9226	0.9298	0.9376	0.9431	0.9488 (40)
HLP (average)												0.9403
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9771 (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 32.0041 31.5288 30.8595 29.6254 28.7013 27.6766 27.1231 27.7878 28.5115 29.6079 30.8674 31.8960 (42b)

Hot water usage for other uses 45.1185 43.4778 41.8371 40.1965 38.5558 36.9151 36.9151 38.5558 40.1965 41.8371 43.4778 45.1185 (42c)

Average daily hot water use (litres/day) 70.6897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	77.1226	75.0067	72.6967	69.8219	67.2571	64.5917	64.0382	66.3436	68.7079	71.4450	74.3453	77.0144 (44)
Energy conte	122.1434	106.8085	111.7320	95.5826	90.5410	79.4231	77.4487	82.1472	84.7237	96.9502	105.9184	120.5860 (45)
Energy content (annual)												Total = Sum(45)m = 1174.0049
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	103.8219	90.7872	94.9722	81.2452	76.9598	67.5096	65.8314	69.8251	72.0152	82.4077	90.0307	102.4981 (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	103.8219	90.7872	94.9722	81.2452	76.9598	67.5096	65.8314	69.8251	72.0152	82.4077	90.0307	102.4981 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 997.9042 (64)
Electric shower(s)	59.3706	52.8997	57.7645	55.1239	56.1583	53.5696	55.3552	56.1583	55.1239	57.7645	56.6783	59.3706 (64a)
Heat gains from water heating, kWh/month	40.7981	35.9217	38.1842	34.0923	33.2795	30.2698	30.2967	31.4959	31.7848	35.0430	36.6772	40.4672 (65)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 998 (64)

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

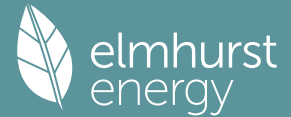
Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	194.7513	215.6175	194.7513	201.2430	194.7513	201.2430	194.7513	194.7513	201.2430	194.7513	201.2430	194.7513 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5890	356.2478	347.0278	327.3996	302.6224	279.3354	263.7782	260.1195	269.3394	288.9677	313.7448	337.0319 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855 (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)	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840 (71)
Water heating gains (Table 5)	54.8362	53.4550	51.3228	47.3504	44.7305	42.0414	40.7213	42.3331	44.1455	47.1009	50.9406	54.3914 (72)
Total internal gains	669.8330	692.9767	660.7584	643.6494	609.7607	590.2762	566.9073	564.8604	582.3844	598.4763	633.5849	653.8310 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610 (74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972 (80)

Full SAP Calculation Printout



Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	787.6959	912.3056	1008.6729	1152.4471	1248.8266	1254.6752	1195.0278	1091.5271	985.5038	853.9189	778.1745	752.4665 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3701	40.5028	40.6338	41.2604	41.3798	41.9448	41.9448	42.0511	41.7253	41.3798	41.1390	40.8902
alpha	3.6913	3.7002	3.7089	3.7507	3.7587	3.7963	3.7963	3.8034	3.7817	3.7587	3.7426	3.7260
util living area	0.9941	0.9892	0.9793	0.9467	0.8711	0.7250	0.5746	0.6365	0.8503	0.9652	0.9896	0.9950 (86)
MIT	18.9623	19.1844	19.5395	20.0644	20.5259	20.8429	20.9516	20.9287	20.6867	20.0903	19.4528	18.9409 (87)
Th 2	20.1159	20.1186	20.1212	20.1334	20.1357	20.1463	20.1463	20.1483	20.1422	20.1357	20.1310	20.1262 (88)
util rest of house	0.9929	0.9871	0.9749	0.9346	0.8401	0.6597	0.4786	0.5417	0.8030	0.9551	0.9871	0.9941 (89)
MIT 2	18.2250	18.4479	18.8025	19.3268	19.7659	20.0485	20.1252	20.1147	19.9237	19.3595	18.7252	18.2110 (90)
Living area fraction									fLA = Living area / (4) =			0.2188 (91)
MIT	18.3864	18.6091	18.9637	19.4882	19.9322	20.2224	20.3060	20.2928	20.0907	19.5194	18.8844	18.3707 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3864	18.6091	18.9637	19.4882	19.9322	20.2224	20.3060	20.2928	20.0907	19.5194	18.8844	18.3707 (93)

8. Space heating requirement

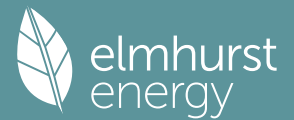
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9897	0.9820	0.9672	0.9234	0.8317	0.6660	0.4975	0.5589	0.7997	0.9457	0.9823	0.9913 (94)
Useful gains	779.5514	895.8601	975.5700	1064.1935	1038.6159	835.6586	594.5172	610.0933	788.1549	807.5852	764.3725	745.8857 (95)
Ext temp.	4.3000	4.9000	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	2450.0700	2376.6333	2153.7783	1801.8921	1396.9060	941.1952	620.3975	650.0185	1008.1277	1513.5228	2011.3766	2433.3987 (97)
Space heating kWh	1242.8658	995.0796	876.5870	531.1430	266.5678	0.0000	0.0000	0.0000	0.0000	525.2176	897.8429	1255.5096 (98a)
Space heating requirement - total per year (kWh/year)												6590.8135
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	1242.8658	995.0796	876.5870	531.1430	266.5678	0.0000	0.0000	0.0000	0.0000	525.2176	897.8429	1255.5096 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6590.8135
Space heating per m2												(98c) / (4) = 36.4174 (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	1573.5823	1238.7776	1269.0411	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7328	0.8108	0.7640	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1153.1981	1004.4558	969.5828	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1367.9518	1302.3810	1185.4703	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	154.6227	221.6564	160.6203	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	38.6557	55.4141	40.1551	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												134.2248 (107)
Energy for space heating												36.4174 (99)
Energy for space cooling												0.7417 (108)
Total												37.1590 (109)
Fabric Energy Efficiency (TFEE)												37.2 (109)

Predicted Energy Assessment

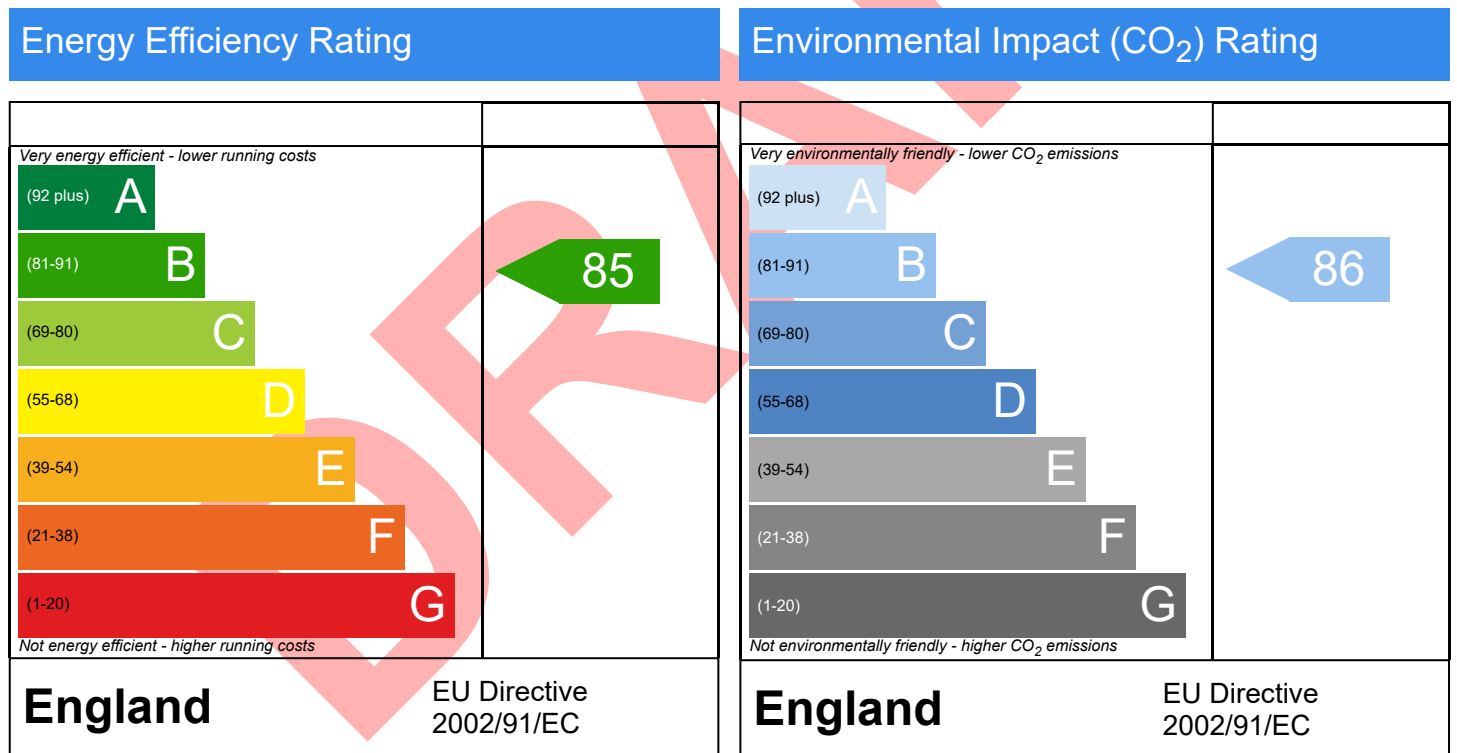


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Semi-Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 180.98 m²
 DRRN:

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.

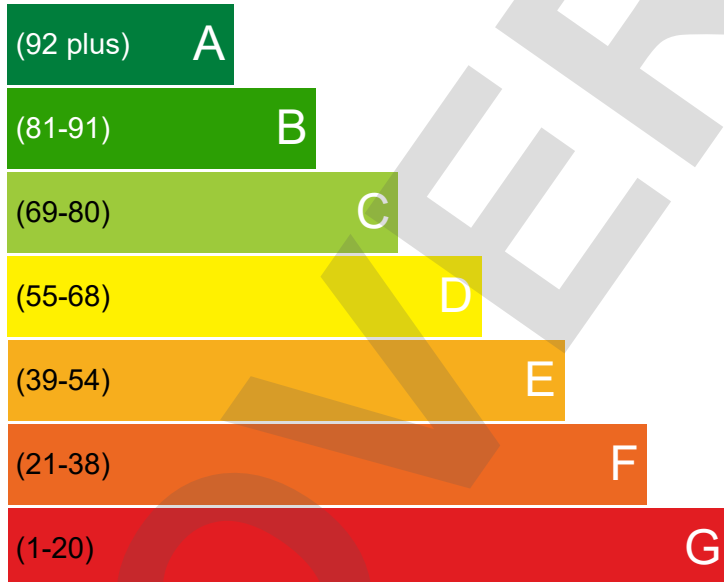
Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Semi-Detached
Floor Area [m ²]	181

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



CURRENT

POTENTIAL

85

85

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excelent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 68 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **2.2** per year

With the recommended measures the potential CO emissions could be: **2** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£699

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:05

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Semi-detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	181 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 4 - Heatpump + PV
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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	10.0 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	1.72 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	52.57 kWh _{PE} /m ²		
Dwelling primary energy	17.51 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	37.2 kWh/m ²		
Dwelling fabric energy efficiency	35.8 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	WEST (1.2)	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)	89.52	0.18
Sheltered wall: Walls (2)	36.26	0.18
Party wall: Party Wall (1)	32.17	0 (!)
Exposed roof: Roof (1)	122.44	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
WEST, Windows	7.43	West	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	East	N/A	1.2
SOUTH, Windows	2.03	South	0.7	1.2
NORTH, Windows	13.62	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

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	3 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	415.8%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	MIDEA
Model	MHC-V16W/D2N8-B
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	500 litres
Declared heat loss	2.1 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

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

Efficiency	
Manufacturer	
Model	

6 Controls

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

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

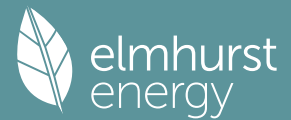
Manufacturer	
Model	

7 Lighting

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	1.79 kWp	
Orientation	South	
Pitch	30°	
Overshading	None or very little	
Manufacturer	PV	
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way		Issued on Date	10/07/2023
Assessment Reference	Flat 4 - Heatpump + PV	Prop Type Ref	20 Watford Way	
Property	20, Watford Way, RADLETT, WD7 8LE			

SAP Rating	92 A	DER	1.72	TER	10.00
Environmental	98 A	% DER < TER			82.80
CO ₂ Emissions (t/year)	0.29	DFEE	35.79	TFEE	37.16
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	66.69	DPER	17.51	TPER	52.57

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	Flat, Semi-Detached	
Position of Flat	Mid-floor flat	
Which Floor	1	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	180.98 m ²	2.79 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

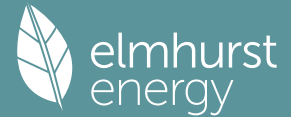
8.0 Living Area	39.60	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	112.60	89.52	0.00	None	23.08	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	39.17	36.26	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	32.17	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	122.44	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



10.1 Party Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	58.54

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	180.98

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
WEST	Windows	EXTERNAL	West	7.43	0
ENTRANCE DOOR	Entrance Door	HALLWAY	East	2.91	0
SOUTH	Windows	EXTERNAL	South	2.03	0
NORTH	Windows	EXTERNAL	North	13.62	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	13.30	0.30	0.30	No
E3 Sill	Independently assessed	6.75	0.04	0.04	No
E4 Jamb	Independently assessed	33.00	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	54.38	0.07	0.07	No
E14 Flat roof	Independently assessed	40.94	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.74	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	19.53	-0.09	-0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	11.53	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	2.83	0.12	0.12	No
E18 Party wall between dwellings	Independently assessed	11.16	0.06	0.06	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m²/(h.m²) @ 50 Pa

Property Tested?

Test Method

As Built AP₅₀ m²/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

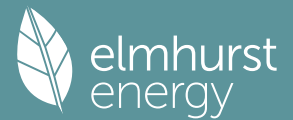
MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

20.0 Fans, Open Fireplaces, Flues

Summary for Input Data



21.0 Fixed Cooling System

No

22.0 Lighting

No Fixed Lighting

No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Database

Percentage of Heat

100.00

%

Database Ref. No.

105566

Fuel Type

Electricity

SAP Code

0

In Winter

0.00

In Summer

0.00

Model Name

MHC-V16W/D2N8-B

Manufacturer

MIDEA

System Type

Heat Pump

Controls SAP Code

2207

Delayed Start Stat

No

Burner Control

Modulating

HETAS approved System

No

Oil Pump Inside

No

FI Case

0.00

Flue Type

None or Unknown

Fan Assisted Flue

No

Is MHS Pumped

Pump in heated space

Heating Pump Age

2013 or later

Heat Emitter

Radiators and Underfloor

Underfloor Heating

Yes - Pipes in thin screed

Flow Temperature

Enter value

Flow Temperature Value

35.00

Boiler Interlock

No

Combi boiler type

No Combi

Combi keep hot type

None

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	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

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

No

Summary for Input Data

Summer Immersion	No
Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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
Independent Time Control	Yes
Insulation Type	Measured Loss
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Loss	2.10 kWh/day
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

None

32.0 Photovoltaic Unit

One Dwelling	One Dwelling							
Export Capable Meter?	No							
Connected To Dwelling	Yes							
Diverter	No							
Battery Capacity [kWh]	0.00							
PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
1.79	South	30°	None Or Little	No	No	1.00		PV

34.0 Small-scale Hydro

None	None										
Electricity Generated	0.00										
Apportioned	0.00 kWh/Year										
Connected to dwelling's electricity meter	Yes										
Electricity Generation	Annual										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

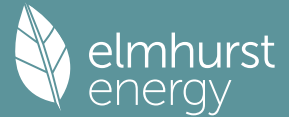
Lower cost measures

None

Further measures to achieve even higher standards

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

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 4 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	92 A	DER	1.72	TER	10.00
Environmental	98 A	% DER < TER			82.80
CO ₂ Emissions (t/year)	0.29	DFEE	35.79	TFEE	37.16
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	66.69	DPER	17.51	TPER	52.57
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	180.9800 (1b)	2.7900 (2b)	504.9342 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.9800		504.9342 (5)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 504.9342 (5)

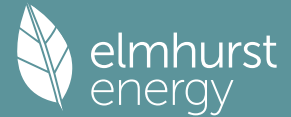
2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)
Wind speed	Jan 5.1000, Feb 5.0000, Mar 4.9000, Apr 4.4000, May 4.3000, Jun 3.8000, Jul 3.8000, Aug 3.7000, Sep 4.0000, Oct 4.3000, Nov 4.5000, Dec 4.7000	(22)
Wind factor	Jan 1.2750, Feb 1.2500, Mar 1.2250, Apr 1.1000, May 1.0750, Jun 0.9500, Jul 0.9500, Aug 0.9250, Sep 1.0000, Oct 1.0750, Nov 1.1250, Dec 1.1750	(22a)
Adj infilt rate	Jan 0.1912, Feb 0.1875, Mar 0.1837, Apr 0.1650, May 0.1612, Jun 0.1425, Jul 0.1425, Aug 0.1388, Sep 0.1500, Oct 0.1612, Nov 0.1687, Dec 0.1762	(22b)
Mechanical extract ventilation - centralised		0.5000 (23a)
If mechanical ventilation		0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		
Effective ac	0.5000, 0.5000, 0.5000, 0.5000, 0.5000, 0.5000, 0.5000, 0.5000, 0.5000, 0.5000, 0.5000, 0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			23.0800	1.1450	26.4275		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	112.6000	23.0800	89.5200	0.1800	16.1136	70.0000	6266.4000 (29a)
HALLWAY	39.1700	2.9100	36.2600	0.1700	6.1642	70.0000	2538.2000 (29a)

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Flat Roof	122.4400	122.4400	0.1100	13.4684	9.0000	1101.9600 (30)
Total net area of external elements Aum(A, m2)		274.2100				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	65.6657			(33)
Party Wall 1		32.1700	0.0000	0.0000	180.0000	5790.6000 (32)
Party Floor 1		180.9800			40.0000	7239.2000 (32d)
Party Ceiling 1		58.5400			30.0000	1756.2000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24692.5600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 136.4381 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.3000	3.9900
E3 Sill	6.7500	0.0400	0.2700
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	54.3800	0.0700	3.8066
E14 Flat roof	40.9400	0.0400	1.6376
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	19.5300	-0.0900	-1.7577
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1123 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 77.7780 (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	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141	83.3141 (38)
Heat transfer coeff	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921	161.0921 (39)
Average = Sum(39)m / 12 =												161.0921

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901	0.8901 (40)
HLP (average)												0.8901
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9771 (42)
Hot water usage for mixer showers	74.1360	73.0219	71.3984	68.2922	65.9998	63.4434	61.9904	63.6016	65.3678	68.1126	71.2855	73.8520 (42a)	
Hot water usage for baths	33.6886	33.1883	32.4837	31.1846	30.2119	29.1333	28.5507	29.2503	30.0121	31.1662	32.4920	33.5747 (42b)	
Hot water usage for other uses	47.4931	45.7661	44.0391	42.3121	40.5851	38.8580	38.8580	40.5851	42.3121	44.0391	45.7661	47.4931 (42c)	
Average daily hot water use (litres/day)													142.7612 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	155.3178	151.9763	147.9212	141.7889	136.7968	131.4347	129.3991	133.4369	137.6919	143.3179	149.5437	154.9198 (44)	
Energy conte	245.9854	216.4122	227.3494	194.1019	184.1547	161.6143	156.4969	165.2228	169.7879	194.4810	213.0524	242.5670 (45)	
Energy content (annual)													Total = Sum(45)m = 2371.2260

Distribution loss (46)m = 0.15 x (45)m
 36.8978 32.4618 34.1024 29.1153 27.6232 24.2421 23.4745 24.7834 25.4682 29.1721 31.9579 36.3851 (46)

Water storage loss:

Store volume 500.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.1340 (55)

Total storage loss 35.1540 31.7520 35.1540 34.0200 35.1540 34.0200 35.1540 35.1540 34.0200 35.1540 34.0200 35.1540 (56)

If cylinder contains dedicated solar storage 35.1540 31.7520 35.1540 34.0200 35.1540 34.0200 35.1540 35.1540 34.0200 35.1540 34.0200 35.1540 (57)

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

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

Total heat required for water heating calculated for each month 304.4018 269.1754 285.7658 250.6339 242.5711 218.1463 214.9133 223.6392 226.3199 252.8974 269.5844 300.9834 (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 304.4018 269.1754 285.7658 250.6339 242.5711 218.1463 214.9133 223.6392 226.3199 252.8974 269.5844 300.9834 (64)

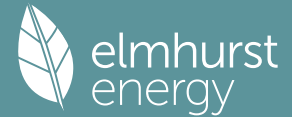
12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 3059.0320 (64)
 3059 (64)

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 128.5233 114.1676 122.3268 109.7645 107.9646 98.9624 98.7684 101.6697 101.6801 111.3980 116.0655 127.3867 (65)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	194.7513	215.6175	194.7513	201.2430	194.7513	201.2430	194.7513	194.7513	201.2430	194.7513	201.2430	194.7513	201.2430	194.7513 (67)
352.5890	352.5890	356.2478	347.0278	327.3996	302.6224	279.3354	263.7782	260.1195	269.3394	288.9677	313.7448	337.0319	337.0319 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855 (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	0.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840 (71)	
Water heating gains (Table 5)	172.7463	169.8923	164.4177	152.4507	145.1137	137.4477	132.7532	136.6528	141.2223	149.7286	161.2021	171.2186	171.2186 (72)	
Total internal gains	787.7431	809.4141	773.8533	748.7497	710.1438	685.6826	658.9392	659.1800	679.4612	701.1040	743.8464	770.6583	770.6583 (73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610 (74)	
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)	
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972 (80)	

Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	905.6060	1028.7429	1121.7678	1257.5473	1349.2097	1350.0816	1287.0597	1185.8468	1082.5806	956.5466	888.4360	869.2937 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	42.5784	
tau	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	3.8386	
util living area	0.9898	0.9825	0.9680	0.9250	0.8327	0.6757	0.5242	0.5819	0.8037	0.9465	0.9824	0.9913 (86)	
Living	19.5770	19.7350	19.9841	20.3314	20.6392	20.8307	20.8941	20.8815	20.7389	20.3434	19.8970	19.5391	
Non living	18.4759	18.6769	18.9931	19.4270	19.7955	20.0026	20.0585	20.0499	19.9142	19.4481	18.8848	18.4274	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2721	19.7350	19.9841	20.3314	20.6392	20.8307	20.8941	20.8815	20.7389	20.3434	19.8970	19.7434 (87)	
Th 2	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759	20.1759 (88)	
util rest of house	0.9879	0.9792	0.9617	0.9098	0.7980	0.6112	0.4360	0.4929	0.7516	0.9327	0.9786	0.9897 (89)	
MIT 2	19.4982	18.6769	18.9931	19.4270	19.7955	20.0026	20.0585	20.0499	19.9142	19.4481	18.8848	18.7425 (90)	
Living area fraction	19.6675	18.9084	19.2099	19.6249	19.9801	20.1838	20.2413	20.2319	20.0946	19.6440	19.1063	18.9615 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.6675	18.9084	19.2099	19.6249	19.9801	20.1838	20.2413	20.2319	20.0946	19.6440	19.1063	18.9615 (93)	

8. Space heating requirement

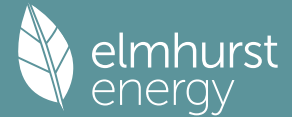
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9865	0.9727	0.9525	0.8976	0.7888	0.6118	0.4433	0.4993	0.7458	0.9214	0.9721	0.9866 (94)	
Useful gains	893.4142	1000.6710	1068.5108	1128.7374	1064.2094	826.0452	570.5973	592.0696	807.3453	881.3986	863.6135	857.6174 (95)	
Ext temp.	4.3000	4.9000	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	2475.5831	2256.6492	2047.4723	1727.7004	1333.8635	899.5052	586.5919	617.2864	965.6884	1456.9142	1934.1219	2377.9614 (97)	
Space heating kWh	1177.1337	844.0173	728.3474	431.2533	200.6227	0.0000	0.0000	0.0000	0.0000	428.1836	770.7660	1131.1360 (98a)	
Space heating requirement - total per year (kWh/year)												5711.4600	
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	1177.1337	844.0173	728.3474	431.2533	200.6227	0.0000	0.0000	0.0000	0.0000	428.1836	770.7660	1131.1360 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												5711.4600	
Space heating per m2												(98c) / (4) =	31.5585 (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 %)	415.7780 (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												

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1177.1337	844.0173	728.3474	431.2533	200.6227	0.0000	0.0000	0.0000	0.0000	0.0000	428.1836	770.7660	1131.1360	(98)
Space heating efficiency (main heating system 1)	415.7780	415.7780	415.7780	415.7780	0.0000	0.0000	0.0000	0.0000	0.0000	415.7780	415.7780	415.7780	(210)
Space heating fuel (main heating system)	283.1159	202.9971	175.1770	103.7220	48.2524	0.0000	0.0000	0.0000	0.0000	102.9837	185.3792	272.0529	(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	304.4018	269.1754	285.7658	250.6339	242.5711	218.1463	214.9133	223.6392	226.3199	252.8974	269.5844	300.9834	(64)
Efficiency of water heater (217)m	285.1084	285.1084	285.1084	285.1084	285.1084	285.1084	285.1084	285.1084	285.1084	285.1084	285.1084	285.1084	(216)
Fuel for water heating, kWh/month	106.7670	94.4116	100.2306	87.9083	85.0803	76.5135	75.3795	78.4401	79.3803	88.7022	94.5551	105.5681	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.1845	11.9086	13.1845	12.7592	13.1845	12.7592	13.1845	13.1845	12.7592	13.1845	12.7592	13.1845	(231)
Lighting	37.6533	30.2069	27.1980	19.9264	15.3917	12.5752	14.0408	18.2508	23.7060	31.1036	35.1314	38.6998	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-35.6799	-54.0820	-83.3781	-99.1959	-110.1368	-101.3476	-99.9771	-91.8643	-78.1288	-63.4331	-40.2415	-30.3456	(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												1373.6802	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												285.1084	
Water heating fuel used												1072.9364	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520) mechanical ventilation fans (SFP = 0.2520)												155.2370	(230a)
Total electricity for the above, kWh/year												155.2370	(231)
Electricity for lighting (calculated in Appendix L)												303.8841	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-887.8108	(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												2017.9269	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1373.6802	0.1550	212.9737 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1072.9364	0.1409	151.2130 (264)
Space and water heating			364.1867 (265)
Pumps, fans and electric keep-hot	155.2370	0.1387	21.5333 (267)
Energy for lighting	303.8841	0.1443	43.8599 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-887.8108	0.1337	-118.6783
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-118.6783 (269)
Total CO2, kg/year			310.9016 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7200 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1373.6802	1.5740	2162.1307 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1072.9364	1.5211	1632.0690 (278)
Space and water heating			3794.1997 (279)

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Pumps, fans and electric keep-hot	155.2370	1.5128	234.8425 (281)
Energy for lighting	303.8841	1.5338	466.1075 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-887.8108	1.4940	-1326.3884
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1326.3884 (283)
Total Primary energy kWh/year			3168.7613 (286)
Dwelling Primary energy Rate (DPER)			17.5100 (287)

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

 1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	180.9800 (1b)	x 2.7900 (2b)	= 504.9342 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	504.9342 (5)

 2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0792 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3292 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3292 (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	0.4198	0.4115	0.4033	0.3621	0.3539	0.3128	0.3128	0.3045	0.3292	0.3539	0.3704	0.3868 (22b)
Effective ac	0.5881	0.5847	0.5813	0.5656	0.5626	0.5489	0.5489	0.5464	0.5542	0.5626	0.5686	0.5748 (25)

 3. Heat losses and heat loss parameter

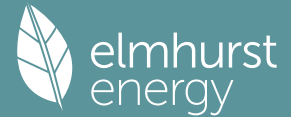
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			23.0800	1.1450	26.4275		(27)
EXTERNAL	112.6000	23.0800	89.5200	0.1800	16.1136		(29a)
HALLWAY	39.1700	2.9100	36.2600	0.1800	6.5268		(29a)
Flat Roof	122.4400		122.4400	0.1100	13.4684		(30)
Total net area of external elements Aum(A, m ²)			274.2100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4463		(33)
Party Wall 1			32.1700	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 139.6727 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.0500	0.6650
E3 Sill	6.7500	0.0500	0.3375
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	54.3800	0.0700	3.8066
E14 Flat roof	40.9400	0.0800	3.2752

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E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	19.5300	-0.0900	-1.7577
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	11.1600	0.0600	0.6696
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.4924 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss		(33) + (36) + (36a) =	75.9387 (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	97.9935	97.4235	96.8647	94.2404	93.7494	91.4637	91.4637	91.0404	92.3441	93.7494	94.7427	95.7812 (38)
Heat transfer coeff	173.9322	173.3622	172.8034	170.1791	169.6881	167.4024	167.4024	166.9791	168.2828	169.6881	170.6814	171.7198 (39)
Average = Sum(39)m / 12 =												170.1767

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9611	0.9579	0.9548	0.9403	0.9376	0.9250	0.9250	0.9226	0.9298	0.9376	0.9431	0.9488 (40)
HLP (average)												0.9403
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9771 (42)
Hot water usage for mixer showers	74.1360	73.0219	71.3984	68.2922	65.9998	63.4434	61.9904	63.6016	65.3678	68.1126	71.2855	73.8520 (42a)	
Hot water usage for baths	32.0041	31.5288	30.8595	29.6254	28.7013	27.6766	27.1231	27.7878	28.5115	29.6079	30.8674	31.8960 (42b)	
Hot water usage for other uses	45.1185	43.4778	41.8371	40.1965	38.5558	36.9151	36.9151	38.5558	40.1965	41.8371	43.4778	45.1185 (42c)	
Average daily hot water use (litres/day)	35.9335	31.6186	33.2203	28.3607	26.9084	23.6151	22.8631	24.1349	24.7993	28.4068	31.1217	35.4331 (46)	139.0406 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.2587	148.0286	144.0951	138.1140	133.2569	128.0352	126.0286	129.9452	134.0757	139.5576	145.6308	150.8664 (44)	
Energy conte	239.5568	210.7907	221.4688	189.0712	179.3894	157.4342	152.4207	160.8992	165.3287	189.3783	207.4778	236.2204 (45)	
Energy content (annual)										Total = Sum(45)m =		2309.4362	
Distribution loss (46)m = 0.15 x (45)m	35.9335	31.6186	33.2203	28.3607	26.9084	23.6151	22.8631	24.1349	24.7993	28.4068	31.1217	35.4331 (46)	

Water storage loss:													500.0000 (47)
Store volume													2.9009 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.5665 (55)
Enter (49) or (54) in (55)													
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (56)	

If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (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	311.3799	275.6632	293.2919	258.5774	251.2125	226.9404	224.2438	232.7224	234.8350	261.2015	276.9840	308.0435 (62)	
WWHRS	-33.8919	-29.9743	-31.3873	-25.9900	-24.2217	-20.7267	-19.4280	-20.6597	-21.4446	-25.2809	-28.6401	-33.2643 (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	277.4880	245.6889	261.9046	232.5875	226.9908	206.2137	204.8159	212.0627	213.3903	235.9206	248.3439	274.7792 (64)	
Total per year (kWh/year) = Sum(64)m =												2840.1860 (64)	2840 (64)

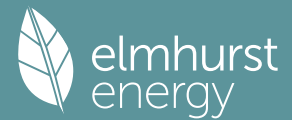
12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)

Heat gains from water heating, kWh/month	137.1111	121.9859	131.0969	118.4712	117.1055	107.9519	108.1384	110.9575	110.5768	120.4268	124.5913	136.0018 (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	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	194.7513	215.6175	194.7513	201.2430	194.7513	201.2430	194.7513	194.7513	201.2430	194.7513	201.2430	194.7513 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5890	356.2478	347.0278	327.3996	302.6224	279.3354	263.7782	260.1195	269.3394	288.9677	313.7448	337.0319 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840 (71)
Water heating gains (Table 5)	184.2891	181.5266	176.2055	164.5433	157.3998	149.9331	145.3473	149.1364	153.5789	161.8640	173.0435	182.7981 (72)
Total internal gains	802.2859	824.0484	788.6410	763.8423	725.4300	698.1680	671.5333	671.6636	691.8178	716.2394	758.6879	785.2377 (73)

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6. Solar gains

[Jan]					Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North					13.6200	10.6334	0.6300		0.7000		0.7700	44.2610 (74)
South					2.0300	46.7521	0.6300		0.7000		0.7700	29.0047 (78)
West					7.4300	19.6403	0.6300		0.7000		0.7700	44.5972 (80)
Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	920.1488	1043.3773	1136.5556	1272.6400	1364.4959	1362.5670	1299.6538	1198.3304	1094.9372	971.6820	903.2774	883.8732 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3701	40.5028	40.6338	41.2604	41.3798	41.9448	41.9448	42.0511	41.7253	41.3798	41.1390	40.8902
alpha	3.6913	3.7002	3.7089	3.7507	3.7587	3.7963	3.7963	3.8034	3.7817	3.7587	3.7426	3.7260
util living area	0.9901	0.9834	0.9702	0.9301	0.8431	0.6877	0.5363	0.5929	0.8134	0.9493	0.9831	0.9915 (86)
MIT	19.0853	19.3032	19.6500	20.1539	20.5864	20.8696	20.9616	20.9440	20.7378	20.1854	19.5667	19.0640 (87)
Th 2	20.1159	20.1186	20.1212	20.1334	20.1357	20.1463	20.1463	20.1483	20.1422	20.1357	20.1310	20.1262 (88)
util rest of house	0.9882	0.9802	0.9641	0.9150	0.8083	0.6212	0.4438	0.5002	0.7606	0.9356	0.9793	0.9899 (89)
MIT 2	17.8463	18.1256	18.5679	19.2069	19.7280	20.0442	20.1253	20.1153	19.9134	19.2557	18.4713	17.8257 (90)
Living area fraction	fLA = Living area / (4) = 0.2188 (91)											
MIT	18.1174	18.3833	18.8046	19.4141	19.9159	20.2248	20.3083	20.2967	20.0938	19.4592	18.7110	18.0966 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1174	18.3833	18.8046	19.4141	19.9159	20.2248	20.3083	20.2967	20.0938	19.4592	18.7110	18.0966 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9820	0.9714	0.9519	0.8997	0.7983	0.6278	0.4621	0.5173	0.7572	0.9216	0.9705	0.9843 (94)
Useful gains	903.5542	1013.4981	1081.8660	1144.9576	1089.2188	855.4345	600.5749	619.8785	829.1395	895.4907	876.6661	869.9968 (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	2403.2961	2337.4923	2126.2842	1789.2782	1394.1323	941.6070	620.7786	650.6606	1008.6508	1503.2928	1981.7852	2386.3292 (97)
Space heating kWh	1115.8079	889.7241	777.0471	463.9109	226.8556	0.0000	0.0000	0.0000	0.0000	452.2048	795.6858	1128.1513 (98a)
Space heating requirement - total per year (kWh/year)	5849.3875											
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	1115.8079	889.7241	777.0471	463.9109	226.8556	0.0000	0.0000	0.0000	0.0000	452.2048	795.6858	1128.1513 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5849.3875											
Space heating per m ²	(98c) / (4) = 32.3206 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 92.3000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1115.8079	889.7241	777.0471	463.9109	226.8556	0.0000	0.0000	0.0000	0.0000	452.2048	795.6858	1128.1513 (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)	1208.8927	963.9481	841.8712	502.6120	245.7807	0.0000	0.0000	0.0000	0.0000	489.9293	862.0647	1222.2657 (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	277.4880	245.6889	261.9046	232.5875	226.9908	206.2137	204.8159	212.0627	213.3903	235.9206	248.3439	274.7792 (64)
Efficiency of water heater	86.8492	86.6845	86.3451	85.5770	84.0584	79.8000	79.8000	79.8000	79.8000	85.4942	86.4800	79.8000 (216)
Fuel for water heating, kWh/month	319.5054	283.4289	303.3228	271.7874	270.0393	258.4132	256.6615	265.7427	267.4064	275.9492	287.1693	316.2714 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)

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Pumps and Fa	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	40.4655	32.4629	29.2292	21.4146	16.5412	13.5143	15.0895	19.6139	25.4765	33.4265	37.7552	41.5901	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-45.1957	-65.2485	-95.9653	-110.4077	-121.0948	-113.6451	-112.1544	-104.8485	-92.3441	-75.6634	-50.1966	-38.8902	(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	-21.0519	-44.7441	-89.8283	-136.2694	-181.5646	-183.0414	-180.9829	-152.6761	-111.1039	-64.5362	-28.2743	-16.6200	(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												6337.3646	(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												3375.6975	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												326.5795	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2236.3475	(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												7889.2941	(238)

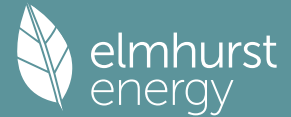
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6337.3646	0.2100	1330.8466 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3375.6975	0.2100	708.8965 (264)
Space and water heating			2039.7430 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	326.5795	0.1443	47.1355 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1025.6544	0.1341	-137.5667
PV Unit electricity exported	-1210.6931	0.1256	-152.0502
Total			-289.6169 (269)
Total CO2, kg/year			1809.1909 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0000 (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	6337.3646	1.1300	7161.2220 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3375.6975	1.1300	3814.5382 (278)
Space and water heating			10975.7601 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	326.5795	1.5338	500.9185 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1025.6544	1.4957	-1534.0516
PV Unit electricity exported	-1210.6931	0.4610	-558.1095
Total			-2092.1611 (283)
Total Primary energy kWh/year			9514.6184 (286)
Target Primary Energy Rate (TPER)			52.5700 (287)

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 4 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	92 A	DER	1.72	TER	10.00
Environmental	98 A	% DER < TER			82.80
CO ₂ Emissions (t/year)	0.29	DFEE	35.79	TFEE	37.16
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	66.69	DPER	17.51	TPER	52.57
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	180.9800 (1b)	2.7900 (2b)	504.9342 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.9800		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 504.9342 (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	4 * 10 = 40.0000 (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) =	40.0000 / (5) =	0.0792 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2292 (18)
Number of sides sheltered		0 (19)

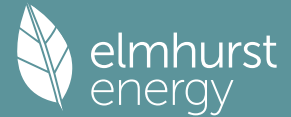
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2292 (21)

	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	0.2923	0.2865	0.2808	0.2521	0.2464	0.2178	0.2178	0.2120	0.2292	0.2464	0.2579	0.2693 (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	0.5427	0.5410	0.5394	0.5318	0.5304	0.5237	0.5237	0.5225	0.5263	0.5304	0.5332	0.5363 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			23.0800	1.1450	26.4275		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	112.6000	23.0800	89.5200	0.1800	16.1136	70.0000	6266.4000 (29a)
HALLWAY	39.1700	2.9100	36.2600	0.1700	6.1642	70.0000	2538.2000 (29a)
Flat Roof	122.4400		122.4400	0.1100	13.4684	9.0000	1101.9600 (30)
Total net area of external elements A _{um} (A, m ²)			274.2100				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	65.6657		(33)
Party Wall 1	32.1700	0.0000	0.0000	180.0000 5790.6000 (32)
Party Floor 1	180.9800			40.0000 7239.2000 (32d)
Party Ceiling 1	58.5400			40.0000 2341.6000 (32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25277.9600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		139.6727	(35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.3000	3.9900
E3 Sill	6.7500	0.0400	0.2700
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	54.3800	0.0700	3.8066
E14 Flat roof	40.9400	0.0400	1.6376
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	19.5300	-0.0900	-1.7577
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	11.1600	0.0600	0.6696

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.1123	(36)
Point Thermal bridges		0.0000	(36a) =
Total fabric heat loss	(33) + (36) + (36a) =	77.7780	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	90.4302	90.1538	89.8830	88.6108	88.3728	87.2648	87.2648	87.0596	87.6916	88.3728	88.8543	89.3577	(38)
Average = Sum(39)m / 12 =	168.2081	167.9318	167.6610	166.3888	166.1508	165.0427	165.0427	164.8375	165.4695	166.1508	166.6323	167.1357	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9294	0.9279	0.9264	0.9194	0.9181	0.9119	0.9119	0.9108	0.9143	0.9181	0.9207	0.9235	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9771 (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	32.0041	31.5288	30.8595	29.6254	28.7013	27.6766	27.1231	27.7878	28.5115	29.6079	30.8674	31.8960	(42b)
Hot water usage for other uses	45.1185	43.4778	41.8371	40.1965	38.5558	36.9151	36.9151	38.5558	40.1965	41.8371	43.4778	45.1185	(42c)
Average daily hot water use (litres/day)													70.6897 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	77.1226	75.0067	72.6967	69.8219	67.2571	64.5917	64.0382	66.3436	68.7079	71.4450	74.3453	77.0144	(44)
Distribution loss (46)m = 0.15 x (45)m	122.1434	106.8085	111.7320	95.5826	90.5410	79.4231	77.4487	82.1472	84.7237	96.9502	105.9184	120.5860	(45)
Total = Sum(45)m =													1174.0049

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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	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	0.0000 (61)

Total heat required for water heating calculated for each month	103.8219	90.7872	94.9722	81.2452	76.9598	67.5096	65.8314	69.8251	72.0152	82.4077	90.0307	102.4981	(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)

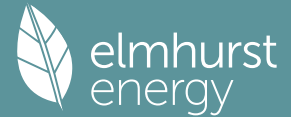
Output from w/h	103.8219	90.7872	94.9722	81.2452	76.9598	67.5096	65.8314	69.8251	72.0152	82.4077	90.0307	102.4981	(64)
Total per year (kWh/year) = Sum(64)m =													997.9042 (64)
Electric shower(s)	59.3706	52.8997	57.7645	55.1239	56.1583	53.5696	55.3552	56.1583	55.1239	57.7645	56.6783	59.3706	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													675.3373 (64a)

Heat gains from water heating, kWh/month	40.7981	35.9217	38.1842	34.0923	33.2795	30.2698	30.2967	31.4959	31.7848	35.0430	36.6772	40.4672	(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	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	194.7513	215.6175	194.7513	201.2430	194.7513	201.2430	194.7513	194.7513	201.2430	194.7513	201.2430	194.7513	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5890	356.2478	347.0278	327.3996	302.6224	279.3354	263.7782	260.1195	269.3394	288.9677	313.7448	337.0319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	(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	0.0000 (70)

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Losses e.g. evaporation (negative values) (Table 5)	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	(71)
Water heating gains (Table 5)	54.8362	53.4550	51.3228	47.3504	44.7305	42.0414	40.7213	42.3331	44.1455	47.1009	50.9406	54.3914	(72)
Total internal gains	669.8330	692.9767	660.7584	643.6494	609.7607	590.2762	566.9073	564.8604	582.3844	598.4763	633.5849	653.8310	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610	(74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047	(78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972	(80)

Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355	(83)
Total gains	787.6959	912.3056	1008.6729	1152.4471	1248.8266	1254.6752	1195.0278	1091.5271	985.5038	853.9189	778.1745	752.4665	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	41.7438	41.8125	41.8801	42.2003	42.2607	42.5445	42.5445	42.5974	42.4347	42.2607	42.1386	42.0117		
alpha	3.7829	3.7875	3.7920	3.8134	3.8174	3.8363	3.8363	3.8398	3.8290	3.8174	3.8092	3.8008		
util living area	0.9941	0.9891	0.9789	0.9453	0.8674	0.7201	0.5689	0.6315	0.8469	0.9645	0.9895	0.9951	(86)	
MIT	19.0358	19.2528	19.5991	20.1016	20.5506	20.8511	20.9549	20.9327	20.7009	20.1202	19.4971	19.0002	(87)	
Th 2	20.1426	20.1438	20.1451	20.1511	20.1522	20.1574	20.1574	20.1583	20.1554	20.1522	20.1499	20.1476	(88)	
util rest of house	0.9930	0.9870	0.9744	0.9331	0.8362	0.6553	0.4744	0.5378	0.7994	0.9543	0.9871	0.9941	(89)	
MIT 2	18.3173	18.5342	18.8789	19.3763	19.8019	20.0647	20.1377	20.1266	19.9468	19.4010	18.7829	18.2854	(90)	
Living area fraction	fLA = Living area / (4) =												0.2188	(91)
MIT	18.4745	18.6915	19.0365	19.5350	19.9657	20.2368	20.3165	20.3030	20.1118	19.5584	18.9392	18.4418	(92)	
Temperature adjustment													0.0000	
adjusted MIT	18.4745	18.6915	19.0365	19.5350	19.9657	20.2368	20.3165	20.3030	20.1118	19.5584	18.9392	18.4418	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Useful gains	779.6644	895.8887	975.2683	1062.7332	1034.4009	830.4667	589.3111	605.7498	785.0640	807.0496	764.3941	745.9764	(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	2384.2697	2316.0279	2101.8807	1769.5494	1373.3517	930.3138	613.3792	643.3602	994.7726	1488.4433	1972.7852	2380.3137	(97)		
Space heating kWh	1193.8263	954.3335	838.1996	508.9076	252.1794	0.0000	0.0000	0.0000	0.0000	506.9569	870.0416	1215.9469	(98a)		
Space heating requirement - total per year (kWh/year)													6340.3919		
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	1193.8263	954.3335	838.1996	508.9076	252.1794	0.0000	0.0000	0.0000	0.0000	506.9569	870.0416	1215.9469	(98c)		
Space heating requirement after solar contribution - total per year (kWh/year)													6340.3919		
Space heating per m2													(98c) / (4) =	35.0337	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b														
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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		
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1551.4017	1221.3162	1252.7653	0.0000	0.0000	0.0000	0.0000	(100)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7406	0.8179	0.7709	0.0000	0.0000	0.0000	0.0000	(101)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1149.0101	998.9301	965.7922	0.0000	0.0000	0.0000	0.0000	(102)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1367.9518	1302.3810	1185.4703	0.0000	0.0000	0.0000	0.0000	(103)	
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	157.6380	225.7675	163.4405	0.0000	0.0000	0.0000	0.0000	(104)	
Intermittency factor (Table 10b)	fc = cooled area / (4) =												1.0000	(105)
Space cooling kWh	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 requirement	0.0000	0.0000	0.0000	0.0000	0.0000	39.4095	56.4419	40.8601	0.0000	0.0000	0.0000	0.0000	(107)	
Energy for space heating													136.7115	(107)
Energy for space cooling													35.0337	(99)
Total													0.7554	(108)
													35.7891	(109)

Fabric Energy Efficiency (DFEE)

35.8 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	180.9800 (1b)	x 2.7900 (2b)	= 504.9342 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	180.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	504.9342 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0792 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3292 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3292 (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	0.4198	0.4115	0.4033	0.3621	0.3539	0.3128	0.3128	0.3045	0.3292	0.3539	0.3704	0.3868 (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	0.5881	0.5847	0.5813	0.5656	0.5626	0.5489	0.5489	0.5464	0.5542	0.5626	0.5686	0.5748 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			23.0800	1.1450	26.4275		(27)
EXTERNAL	112.6000	23.0800	89.5200	0.1800	16.1136		(29a)
HALLWAY	39.1700	2.9100	36.2600	0.1800	6.5268		(29a)
Flat Roof	122.4400		122.4400	0.1100	13.4684		(30)
Total net area of external elements Aum(A, m ²)			274.2100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	65.4463	(33)
Party Wall 1			32.1700	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 139.6727 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.0500	0.6650
E3 Sill	6.7500	0.0500	0.3375
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	54.3800	0.0700	3.8066
E14 Flat roof	40.9400	0.0800	3.2752
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	19.5300	-0.0900	-1.7577
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	11.1600	0.0600	0.6696
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.4924 (36)

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Point Thermal bridges													(36a) =	0.0000
Total fabric heat loss													(33) + (36) + (36a) =	75.9387 (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	97.9935	97.4235	96.8647	94.2404	93.7494	91.4637	91.4637	91.0404	92.3441	93.7494	94.7427	95.7812	(38)	
Average = Sum(39)m / 12 =	173.9322	173.3622	172.8034	170.1791	169.6881	167.4024	167.4024	166.9791	168.2828	169.6881	170.6814	171.7198	(39)	170.1767
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	0.9611	0.9579	0.9548	0.9403	0.9376	0.9250	0.9250	0.9226	0.9298	0.9376	0.9431	0.9488	(40)	0.9403
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		31

4. Water heating energy requirements (kWh/year)

Assumed occupancy														2.9771 (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	32.0041	31.5288	30.8595	29.6254	28.7013	27.6766	27.1231	27.7878	28.5115	29.6079	30.8674	31.8960		(42b)
Hot water usage for other uses	45.1185	43.4778	41.8371	40.1965	38.5558	36.9151	36.9151	38.5558	40.1965	41.8371	43.4778	45.1185		(42c)
Average daily hot water use (litres/day)														70.6897 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	77.1226	75.0067	72.6967	69.8219	67.2571	64.5917	64.0382	66.3436	68.7079	71.4450	74.3453	77.0144	(44)	
Energy content (annual)	122.1434	106.8085	111.7320	95.5826	90.5410	79.4231	77.4487	82.1472	84.7237	96.9502	105.9184	120.5860	(45)	1174.0049
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		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		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		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		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		0.0000 (61)
Total heat required for water heating calculated for each month	103.8219	90.7872	94.9722	81.2452	76.9598	67.5096	65.8314	69.8251	72.0152	82.4077	90.0307	102.4981		102.4981 (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	103.8219	90.7872	94.9722	81.2452	76.9598	67.5096	65.8314	69.8251	72.0152	82.4077	90.0307	102.4981		102.4981 (64)
12Total per year (kWh/year)														997.9042 (64)
Electric shower(s)	59.3706	52.8997	57.7645	55.1239	56.1583	53.5696	55.3552	56.1583	55.1239	57.7645	56.6783	59.3706		59.3706 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														675.3373 (64a)
Heat gains from water heating, kWh/month	40.7981	35.9217	38.1842	34.0923	33.2795	30.2698	30.2967	31.4959	31.7848	35.0430	36.6772	40.4672		(65)

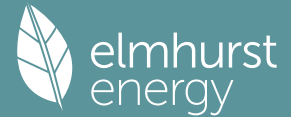
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	148.8550	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	194.7513	215.6175	194.7513	201.2430	194.7513	201.2430	194.7513	194.7513	201.2430	194.7513	201.2430	194.7513	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	352.5890	356.2478	347.0278	327.3996	302.6224	279.3354	263.7782	260.1195	269.3394	288.9677	313.7448	337.0319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	37.8855	(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)	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	-119.0840	(71)
Water heating gains (Table 5)	54.8362	53.4550	51.3228	47.3504	44.7305	42.0414	40.7213	42.3331	44.1455	47.1009	50.9406	54.3914	(72)
Total internal gains	669.8330	692.9767	660.7584	643.6494	609.7607	590.2762	566.9073	564.8604	582.3844	598.4763	633.5849	653.8310	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610 (74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972 (80)

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Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	787.6959	912.3056	1008.6729	1152.4471	1248.8266	1254.6752	1195.0278	1091.5271	985.5038	853.9189	778.1745	752.4665 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3701	40.5028	40.6338	41.2604	41.3798	41.9448	41.9448	42.0511	41.7253	41.3798	41.1390	40.8902
alpha	3.6913	3.7002	3.7089	3.7507	3.7587	3.7963	3.7963	3.8034	3.7817	3.7587	3.7426	3.7260
util living area	0.9941	0.9892	0.9793	0.9467	0.8711	0.7250	0.5746	0.6365	0.8503	0.9652	0.9896	0.9950 (86)
MIT	18.9623	19.1844	19.5395	20.0644	20.5259	20.8429	20.9516	20.9287	20.6867	20.0903	19.4528	18.9409 (87)
Th 2	20.1159	20.1186	20.1212	20.1334	20.1357	20.1463	20.1463	20.1483	20.1422	20.1357	20.1310	20.1262 (88)
util rest of house	0.9929	0.9871	0.9749	0.9346	0.8401	0.6597	0.4786	0.5417	0.8030	0.9551	0.9871	0.9941 (89)
MIT 2	18.2250	18.4479	18.8025	19.3268	19.7659	20.0485	20.1252	20.1147	19.9237	19.3595	18.7252	18.2110 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.3864	18.6091	18.9637	19.4882	19.9322	20.2224	20.3060	20.2928	20.0907	19.5194	18.8844	18.3707 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3864	18.6091	18.9637	19.4882	19.9322	20.2224	20.3060	20.2928	20.0907	19.5194	18.8844	18.3707 (93)

8. Space heating requirement

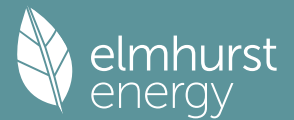
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9897	0.9820	0.9672	0.9234	0.8317	0.6660	0.4975	0.5589	0.7997	0.9457	0.9823	0.9913 (94)
Useful gains	779.5514	895.8601	975.5700	1064.1935	1038.6159	835.6586	594.5172	610.0933	788.1549	807.5852	764.3725	745.8857 (95)
Ext temp.	4.3000	4.9000	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	2450.0700	2376.6333	2153.7783	1801.8921	1396.9060	941.1952	620.3975	650.0185	1008.1277	1513.5228	2011.3766	2433.3987 (97)
Space heating kWh	1242.8658	995.0796	876.5870	531.1430	266.5678	0.0000	0.0000	0.0000	0.0000	525.2176	897.8429	1255.5096 (98a)
Space heating requirement - total per year (kWh/year)												6590.8135
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	1242.8658	995.0796	876.5870	531.1430	266.5678	0.0000	0.0000	0.0000	0.0000	525.2176	897.8429	1255.5096 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6590.8135
Space heating per m2												(98c) / (4) = 36.4174 (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	1573.5823	1238.7776	1269.0411	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7328	0.8108	0.7640	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1153.1981	1004.4558	969.5828	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1367.9518	1302.3810	1185.4703	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	154.6227	221.6564	160.6203	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	38.6557	55.4141	40.1551	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												134.2248 (107)
Energy for space heating												36.4174 (99)
Energy for space cooling												0.7417 (108)
Total												37.1590 (109)
Fabric Energy Efficiency (TFEE)												37.2 (109)

Predicted Energy Assessment

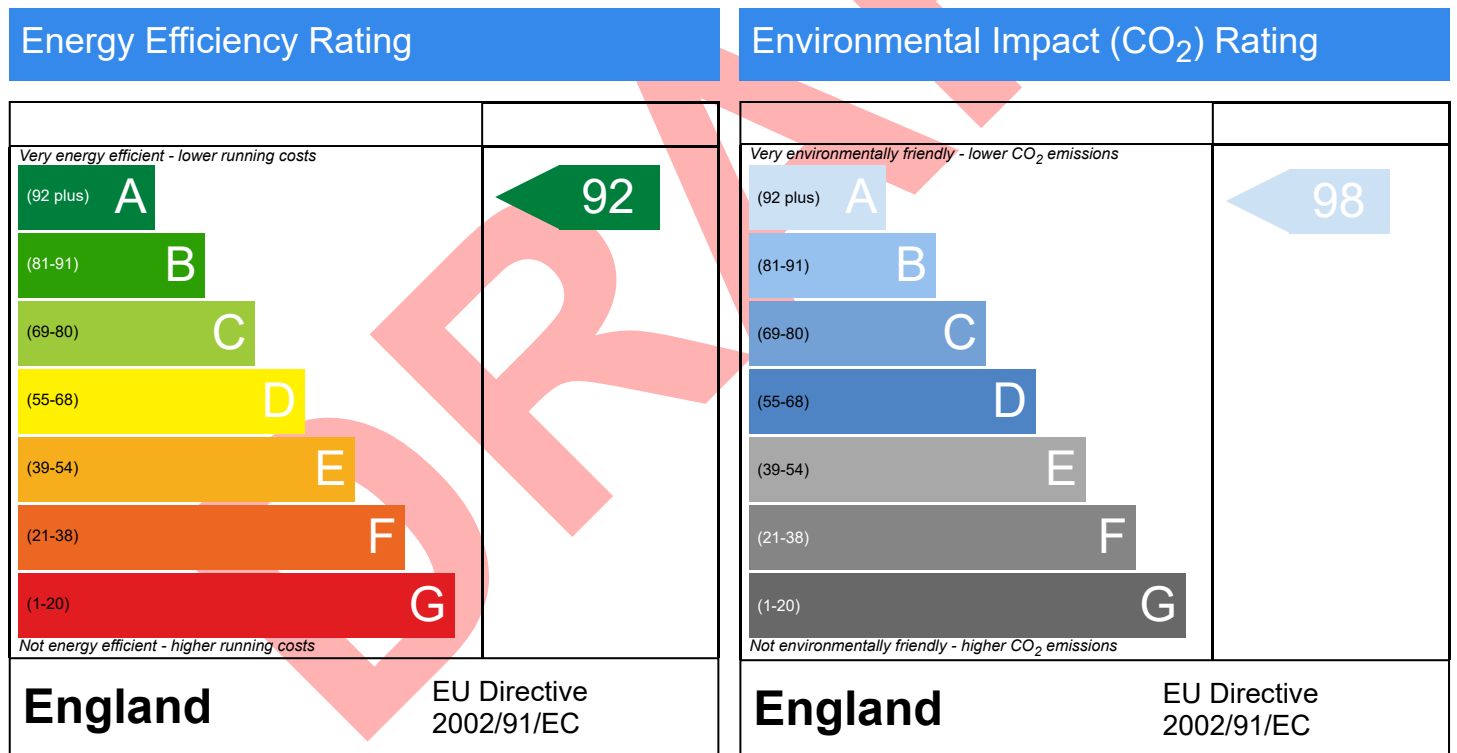


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Semi-Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 180.98 m²
 DRRN:

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.

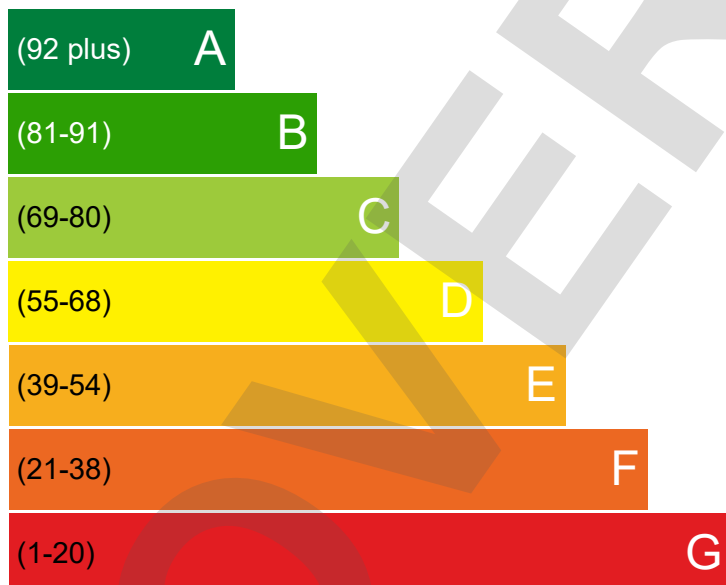
Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Semi-Detached
Floor Area [m ²]	181

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



CURRENT



POTENTIAL



Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excelent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 16 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is:	0.3	per year
With the recommended measures the potential CO emissions could be:	0	per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£398

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:03

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Semi-detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	183 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 5 - Boiler
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	9.88 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	12.72 kgCO ₂ /m ²		FAIL
1b Target primary energy rate and dwelling primary energy			
Target primary energy	51.95 kWh _{PE} /m ²		
Dwelling primary energy	70.75 kWh _{PE} /m ²		FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	36.8 kWh/m ²		
Dwelling fabric energy efficiency	35.4 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	WEST (1.2)	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)	87.96	0.18	
Sheltered wall: Walls (2)	33.03	0.18	
Party wall: Party Wall (1)	32.17	0 (!)	
Exposed roof: Roof (1)	124.17	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
WEST, Windows	7.43	West	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	East	N/A	1.2
SOUTH, Windows	2.03	South	0.7	1.2
NORTH, Windows	13.62	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

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	3 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

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

Efficiency	84.2%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Regular boiler
Manufacturer	Vaillant
Model	ecoFIT pure 630
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	500 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

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

Efficiency	
Manufacturer	
Model	

6 Controls

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

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

7 Lighting

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 5 - Boiler	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	86 B	DER	12.72	TER	9.88
Environmental	87 B	% DER < TER			-28.74
CO ₂ Emissions (t/year)	2.2	DFEE	35.42	TFEE	36.78
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	-36.18	DPER	70.75	TPER	51.95

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	Flat, Semi-Detached	
Position of Flat	Mid-floor flat	
Which Floor	1	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	182.76 m ²	2.79 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

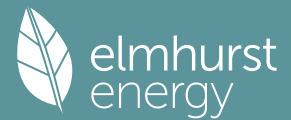
8.0 Living Area	39.60	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	111.04	87.96	0.00	None	23.08	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	35.94	33.03	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	32.17	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	124.17	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



10.1 Party Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	58.59

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	182.76

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
WEST	Windows	EXTERNAL	West	7.43	0
ENTRANCE DOOR	Entrance Door	HALLWAY	East	2.91	0
SOUTH	Windows	EXTERNAL	South	2.03	0
NORTH	Windows	EXTERNAL	North	13.62	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	13.30	0.30	0.30	No
E3 Sill	Independently assessed	6.75	0.04	0.04	No
E4 Jamb	Independently assessed	33.00	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	52.68	0.07	0.07	No
E14 Flat roof	Independently assessed	40.92	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.74	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	16.74	-0.09	-0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	11.53	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	2.83	0.12	0.12	No
E18 Party wall between dwellings	Independently assessed	8.37	0.06	0.06	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m²/(h.m²) @ 50 Pa

Property Tested?

Test Method

As Built AP₅₀ m²/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

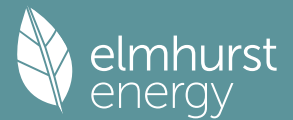
MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

20.0 Fans, Open Fireplaces, Flues

Summary for Input Data



21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

SAP Code

In Winter

In Summer

Model Name

Manufacturer

System Type

Controls SAP Code

Delayed Start Stat

Burner Control

HETAS approved System

Oil Pump Inside

FI Case

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heating Pump Age

Heat Emitter

Underfloor Heating

Flow Temperature

Boiler Interlock

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

26.0 Heat Networks

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

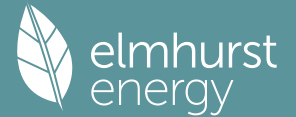
Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

Summer Immersion

Summary for Input Data



Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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
Independent Time Control	Yes
Insulation Type	Foam
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

Thermal Store	None
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Recommendations

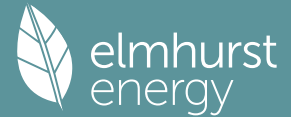
Lower cost measures

None

Further measures to achieve even higher standards

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

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 5 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	86 B	DER	12.72	TER	9.88
Environmental	87 B	% DER < TER			-28.74
CO ₂ Emissions (t/year)	2.2	DFEE	35.42	TFEE	36.78
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	-36.18	DPER	70.75	TPER	51.95
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	182.7600 (1b)	2.7900 (2b)	509.9004 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.7600		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 509.9004 (5)

2. Ventilation rate

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

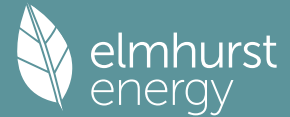
	Value	Reference
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			23.0800	1.1450	26.4275		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	111.0400	23.0800	87.9600	0.1800	15.8328	70.0000	6157.2000 (29a)
HALLWAY	35.9400	2.9100	33.0300	0.1700	5.6151	70.0000	2312.1000 (29a)

Full SAP Calculation Printout



Flat Roof	124.1700	124.1700	0.1100	13.6587	9.0000	1117.5300	(30)
Total net area of external elements Aum(A, m2)		271.1500					(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	65.0261				(33)
Party Wall 1		32.1700	0.0000	0.0000	180.0000	5790.6000	(32)
Party Floor 1		182.7600			40.0000	7310.4000	(32d)
Party Ceiling 1		58.5900			30.0000	1757.7000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24445.5300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 133.7576 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.3000	0.3000	3.9900
E3 Sill	6.7500	0.0400	0.2700
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	52.6800	0.0700	3.6876
E14 Flat roof	40.9200	0.0400	1.6368
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	8.3700	0.0600	0.5022

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.0762 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 77.1023 (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	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336
Heat transfer coeff												
	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358
Average = Sum(39)m / 12 =												161.2358

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822
HLP (average)												0.8822
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9794 (42)

Hot water usage for mixer showers	74.1752	73.0605	71.4361	68.3282	66.0347	63.4769	62.0231	63.6351	65.4023	68.1485	71.3232	73.8910
Hot water usage for baths	33.7063	33.2057	32.5008	31.2010	30.2278	29.1486	28.5657	29.2657	30.0278	31.1826	32.5091	33.5923
Hot water usage for other uses	47.5183	45.7904	44.0624	42.3345	40.6065	38.8786	38.8786	40.6065	42.3345	44.0624	45.7904	47.5183
Average daily hot water use (litres/day)												142.8365

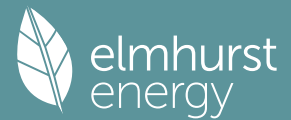
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	155.3998	152.0565	147.9993	141.8637	136.8690	131.5041	129.4674	133.5074	137.7646	143.3935	149.6226	155.0016
Energy conte	246.1152	216.5265	227.4694	194.2043	184.2519	161.6996	156.5796	165.3100	169.8775	194.5836	213.1649	242.6951
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	36.9173	32.4790	34.1204	29.1306	27.6378	24.2549	23.4869	24.7965	25.4816	29.1875	31.9747	36.4043
Water storage loss:												
Store volume												500.0000
b) If manufacturer declared loss factor is not known:												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0115
Volume factor from Table 2a												0.6214
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												1.9376
Total storage loss	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650
If cylinder contains dedicated solar storage	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650
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
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
Total heat required for water heating calculated for each month	329.4427	291.7899	310.7968	274.8438	267.5794	242.3391	239.9070	248.6374	250.5169	277.9111	293.8043	326.0225
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
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
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
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
Output from w/h	329.4427	291.7899	310.7968	274.8438	267.5794	242.3391	239.9070	248.6374	250.5169	277.9111	293.8043	326.0225
Total per year (kWh/year) = Sum(64)m =												3353.5909
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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000
Heat gains from water heating, kWh/month	148.4953	132.2058	142.2955	129.0845	127.9257	118.2767	118.7246	121.6275	120.9958	131.3610	135.3889	147.3580

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
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Full SAP Calculation Printout



(66)m	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	196.1495	217.1656	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495	202.6879	196.1495	202.6879	196.1495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3504	358.0274	348.7614	329.0351	304.1342	280.7308	265.0959	261.4189	270.6849	290.4112	315.3122	338.7155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	(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)	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	(71)
Water heating gains (Table 5)	199.5904	196.7349	191.2574	179.2840	171.9432	164.2732	159.5761	163.4778	168.0498	176.5605	188.0401	198.0619	(72)
Total internal gains	820.7818	842.6194	806.8599	781.6985	742.9184	715.3834	688.5131	688.7378	709.1140	733.8128	776.7316	803.6185	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610	(74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047	(78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972	(80)

Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355	(83)
Total gains	938.6447	1061.9482	1154.7744	1290.4961	1381.9843	1379.7823	1316.6337	1215.4045	1112.2334	989.2553	921.3212	902.2539	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, ni1,m (see Table 9a)	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	21.0000 (85)
tau	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	
alpha	0.9881	0.9801	0.9643	0.9187	0.8230	0.6650	0.5140	0.5702	0.7921	0.9403	0.9798	0.9898	(86)
util living area	19.5886	19.7469	19.9961	20.3421	20.6461	20.8328	20.8943	20.8823	20.7445	20.3562	19.9101	19.5504	(87)
MIT	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	(88)
Th 2	0.9860	0.9765	0.9576	0.9027	0.7879	0.6012	0.4278	0.4830	0.7395	0.9254	0.9755	0.9880	(89)
util rest of house	18.4970	18.6984	19.0145	19.4459	19.8089	20.0104	20.0648	20.0566	19.9256	19.4697	18.9078	18.4485	(90)
MIT 2	18.7336	18.9256	19.2272	19.6401	19.9903	20.1886	20.2445	20.2355	20.1031	19.6618	19.1250	18.6872	(92)
Living area fraction	18.7336	18.9256	19.2272	19.6401	19.9903	20.1886	20.2445	20.2355	20.1031	19.6618	19.1250	18.6872	(92)
MIT	18.7336	18.9256	19.2272	19.6401	19.9903	20.1886	20.2445	20.2355	20.1031	19.6618	19.1250	18.6872	(93)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
adjusted MIT	18.7336	18.9256	19.2272	19.6401	19.9903	20.1886	20.2445	20.2355	20.1031	19.6618	19.1250	18.6872	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9810	0.9694	0.9477	0.8901	0.7786	0.6017	0.4346	0.4890	0.7338	0.9136	0.9682	0.9834	(94)
Useful gains	920.7675	1029.4125	1094.4133	1148.7026	1076.0181	830.2271	572.2339	594.2999	816.1053	903.7821	892.0566	887.2982	(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	2327.2065	2261.4300	2052.0785	1731.6905	1336.6982	901.0826	587.6292	618.4227	967.9095	1461.0883	1938.8571	2335.8608	(97)
Space heating kWh	1046.3906	827.9157	712.5029	419.7513	193.9460	0.0000	0.0000	0.0000	0.0000	414.6359	753.6964	1077.7306	(98a)
Space heating requirement - total per year (kWh/year)												5446.5694	
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	1046.3906	827.9157	712.5029	419.7513	193.9460	0.0000	0.0000	0.0000	0.0000	414.6359	753.6964	1077.7306	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5446.5694	
Space heating per m ²										(98c) / (4) =		29.8018	(99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												84.2000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	1046.3906	827.9157	712.5029	419.7513	193.9460	0.0000	0.0000	0.0000	0.0000	414.6359	753.6964	1077.7306	(98)
Space heating efficiency (main heating system 1)	84.2000	84.2000	84.2000	84.2000	84.2000	0.0000	0.0000	0.0000	0.0000	84.2000	84.2000	84.2000	(210)

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Space heating fuel (main heating system)	1242.7442	983.2728	846.2029	498.5170	230.3396	0.0000	0.0000	0.0000	0.0000	492.4416	895.1263	1279.9650	(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	329.4427	291.7899	310.7968	274.8438	267.5794	242.3391	239.9070	248.6374	250.5169	277.9111	293.8043	326.0225	(64)	
Efficiency of water heater	(217)m	81.8658	81.6656	81.2600	80.4076	78.7510	75.2000	75.2000	75.2000	75.2000	80.3562	81.4781	81.9342	(216)
Fuel for water heating, kWh/month	402.4177	357.2986	382.4722	341.8133	339.7789	322.2594	319.0252	330.6349	333.1342	345.8489	360.5932	397.9076	(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	(221)	
Pumps and Fa	20.6183	18.6230	20.6183	19.9532	20.6183	19.9532	20.6183	20.6183	19.9532	20.6183	19.9532	20.6183	(231)	
Lighting	37.9237	30.4238	27.3933	20.0695	15.5022	12.6655	14.1417	18.3819	23.8762	31.3269	35.3837	38.9777	(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												6468.6097	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												80.2000		
Water heating fuel used												4233.1843	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)														
mechanical ventilation fans (SFP = 0.2520)												156.7638	(230a)	
central heating pump												41.0000	(230c)	
main heating flue fan												45.0000	(230e)	
Total electricity for the above, kWh/year												242.7638	(231)	
Electricity for lighting (calculated in Appendix L)												306.0659	(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												11250.6236	(238)	

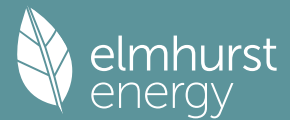
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6468.6097	0.2100	1358.4080	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	4233.1843	0.2100	888.9687	(264)
Space and water heating			2247.3767	(265)
Pumps, fans and electric keep-hot	242.7638	0.1387	33.6743	(267)
Energy for lighting	306.0659	0.1443	44.1748	(268)
Total CO2, kg/year			2325.2258	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.7200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	6468.6097	1.1300	7309.5289	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	4233.1843	1.1300	4783.4982	(278)
Space and water heating			12093.0272	(279)
Pumps, fans and electric keep-hot	242.7638	1.5128	367.2530	(281)
Energy for lighting	306.0659	1.5338	469.4541	(282)
Total Primary energy kWh/year			12929.7343	(286)
Dwelling Primary energy Rate (DPER)			70.7500	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	x	Storey height (m)	=	Volume (m ³)
Ground floor	182.7600 (1b)		2.7900 (2b)		509.9004 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.7600				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 509.9004 (5)

2. Ventilation rate

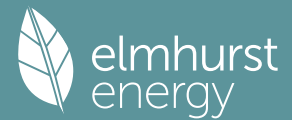
	m ³ per hour												
Number of open chimneys													0 * 80 = 0.0000 (6a)
Number of open flues													0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire													0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler													0 * 20 = 0.0000 (6d)
Number 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													4 * 10 = 40.0000 (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) =													40.0000 / (5) = 0.0784 (8)
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													5.0000 (17)
Infiltration rate													0.3284 (18)
Number of sides sheltered													0 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.3284 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.4188	0.4106	0.4023	0.3613	0.3531	0.3120	0.3120	0.3038	0.3284	0.3531	0.3695	0.3859	(22b)
	0.5877	0.5843	0.5809	0.5653	0.5623	0.5487	0.5487	0.5462	0.5539	0.5623	0.5683	0.5745	(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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			23.0800	1.1450	26.4275		(27)
EXTERNAL	111.0400	23.0800	87.9600	0.1800	15.8328		(29a)
HALLWAY	35.9400	2.9100	33.0300	0.1800	5.9454		(29a)
Flat Roof	124.1700		124.1700	0.1100	13.6587		(30)
Total net area of external elements Aum(A, m ²)			271.1500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 64.7744		(33)
Party Wall 1			32.1700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							136.9634 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				13.3000	0.0500		0.6650
E3 Sill				6.7500	0.0500		0.3375
E4 Jamb				33.0000	0.0500		1.6500
E7 Party floor between dwellings (in blocks of flats)				52.6800	0.0700		3.6876
E14 Flat roof				40.9200	0.0800		3.2736
E16 Corner (normal)				16.7400	0.0900		1.5066
E17 Corner (inverted - internal area greater than external area)				16.7400	-0.0900		-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				11.5300	0.0000		0.0000
P4 Party wall - Roof (insulation at ceiling level)				2.8300	0.1200		0.3396
E18 Party wall between dwellings				8.3700	0.0600		0.5022
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4555 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 75.2299 (37)

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

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(38)m	98.8879	98.3150	97.7534	95.1156	94.6221	92.3247	92.3247	91.8993	93.2097	94.6221	95.6205	96.6643 (38)
Heat transfer coeff	174.1178	173.5448	172.9833	170.3455	169.8520	167.5546	167.5546	167.1292	168.4395	169.8520	170.8504	171.8941 (39)
Average = Sum(39)m / 12 =												170.3432

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9527	0.9496	0.9465	0.9321	0.9294	0.9168	0.9168	0.9145	0.9216	0.9294	0.9348	0.9405 (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													2.9794 (42)	
Hot water usage for mixer showers														2.9794 (42)
Hot water usage for baths	74.1752	73.0605	71.4361	68.3282	66.0347	63.4769	62.0231	63.6351	65.4023	68.1485	71.3232	73.8910	73.8910 (42a)	
Hot water usage for other uses	32.0210	31.5454	30.8757	29.6410	28.7164	27.6912	27.1374	27.8024	28.5264	29.6235	30.8837	31.9127	31.9127 (42b)	
Average daily hot water use (litres/day)	45.1424	43.5008	41.8593	40.2178	38.5762	36.9347	36.9347	38.5762	40.2178	41.8593	43.5008	45.1424	45.1424 (42c)	
Daily hot water use													139.1140 (43)	
Energy conte	151.3385	148.1067	144.1711	138.1869	133.3273	128.1027	126.0952	130.0137	134.1465	139.6313	145.7077	150.9461	150.9461 (44)	
Energy content (annual)	239.6832	210.9020	221.5857	189.1710	179.4841	157.5173	152.5012	160.9842	165.4160	189.4783	207.5873	236.3451	236.3451 (45)	
Distribution loss (46)m = 0.15 x (45)m													2310.6553	
Water storage loss:	35.9525	31.6353	33.2379	28.3757	26.9226	23.6276	22.8752	24.1476	24.8124	28.4217	31.1381	35.4518	35.4518 (46)	
Store volume													500.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													2.9009 (48)	
Temperature factor from Table 2b													0.5400 (49)	
Enter (49) or (54) in (55)													1.5665 (55)	
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607 (56)	
If cylinder contains dedicated solar storage														
Primary loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607 (57)	
Combi 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)	
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
WWHRS	311.5063	275.7745	293.4088	258.6772	251.3072	227.0235	224.3243	232.8073	234.9222	261.3014	277.0935	308.1682	308.1682 (62)	
PV diverter	-33.9098	-29.9901	-31.4039	-26.0037	-24.2345	-20.7376	-19.4382	-20.6706	-21.4559	-25.2942	-28.6553	-33.2818	-33.2818 (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	-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	0.0000 (63c)	
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Total per year (kWh/year)	277.5966	245.7844	262.0049	232.6736	227.0727	206.2859	204.8861	212.1367	213.4663	236.0072	248.4383	274.8864	274.8864 (64)	
Electric shower(s)													2841 (64)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)	
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
	137.1532	122.0229	131.1357	118.5043	117.1370	107.9795	108.1651	110.9857	110.6058	120.4600	124.6278	136.0432	136.0432 (65)	

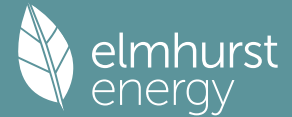
5. Internal gains (see Table 5 and 5a)

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	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	196.1495	217.1656	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	354.3504	358.0274	348.7614	329.0351	304.1342	280.7308	265.0959	261.4189	270.6849	290.4112	315.3122	338.7155	338.7155 (68)
Pumps, fans	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774 (71)
Total internal gains	184.3457	181.5817	176.2577	164.5894	157.4421	149.9715	145.3832	149.1744	153.6192	161.9086	173.0941	182.8538	182.8538 (72)
	805.5371	827.4662	791.8601	767.0038	728.4174	701.0817	674.3202	674.4343	694.6835	719.1609	761.7856	788.4104	788.4104 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610 (74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972 (80)

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Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	923.4000	1046.7951	1139.7747	1275.8015	1367.4832	1365.4807	1302.4408	1201.1010	1097.8029	974.6035	906.3752	887.0458 (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	39.9337	40.0656	40.1957	40.8181	40.9367	41.4980	41.4980	41.6036	41.2799	40.9367	40.6975	40.4503
alpha	3.6622	3.6710	3.6797	3.7212	3.7291	3.7665	3.7665	3.7736	3.7520	3.7291	3.7132	3.6967
util living area	0.9897	0.9828	0.9693	0.9287	0.8414	0.6861	0.5352	0.5915	0.8115	0.9481	0.9825	0.9911 (86)
MIT	19.0721	19.2916	19.6404	20.1473	20.5822	20.8676	20.9607	20.9430	20.7351	20.1797	19.5571	19.0507 (87)
Th 2	20.1229	20.1256	20.1282	20.1403	20.1426	20.1532	20.1532	20.1552	20.1491	20.1426	20.1380	20.1332 (88)
util rest of house	0.9878	0.9796	0.9632	0.9136	0.8069	0.6204	0.4438	0.5000	0.7592	0.9342	0.9787	0.9895 (89)
MIT 2	17.8364	18.1175	18.5624	19.2051	19.7295	20.0488	20.1315	20.1212	19.9168	19.2551	18.4658	17.8156 (90)
Living area fraction	fLA = Living area / (4) =											0.2167 (91)
MIT	18.1042	18.3719	18.7960	19.4093	19.9142	20.2262	20.3112	20.2993	20.0941	19.4554	18.7023	18.0832 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1042	18.3719	18.7960	19.4093	19.9142	20.2262	20.3112	20.2993	20.0941	19.4554	18.7023	18.0832 (93)

8. Space heating requirement

Utilisation	0.9813	0.9704	0.9506	0.8979	0.7964	0.6265	0.4616	0.5165	0.7553	0.9199	0.9695	0.9837 (94)
Useful gains	906.0873	1015.8072	1083.4695	1145.5642	1089.0414	855.4869	601.1480	620.3172	829.1969	896.5529	878.7699	872.5436 (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	2403.5480	2337.9837	2126.9936	1790.2057	1395.2063	942.6968	621.8209	651.6801	1009.6488	1504.1135	1982.2532	2386.4468 (97)
Space heating kWh	1114.1107	888.5026	776.3819	464.1419	227.7867	0.0000	0.0000	0.0000	0.0000	452.0251	794.5079	1126.3440 (98a)
Space heating requirement - total per year (kWh/year)												5843.8009
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	1114.1107	888.5026	776.3819	464.1419	227.7867	0.0000	0.0000	0.0000	0.0000	452.0251	794.5079	1126.3440 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5843.8009
Space heating per m2												(98c) / (4) = 31.9753 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1114.1107	888.5026	776.3819	464.1419	227.7867	0.0000	0.0000	0.0000	0.0000	452.0251	794.5079	1126.3440 (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)	1207.0538	962.6247	841.1505	502.8623	246.7895	0.0000	0.0000	0.0000	0.0000	489.7346	860.7886	1220.3077 (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	277.5966	245.7844	262.0049	232.6736	227.0727	206.2859	204.8861	212.1367	213.4663	236.0072	248.4383	274.8864 (64)
Efficiency of water heater (217)m	86.8463	86.6816	86.3429	85.5772	84.0668	79.8000	79.8000	79.8000	79.8000	85.4926	86.4768	79.8000 (216)
Fuel for water heating, kWh/month	319.6412	283.5484	303.4468	271.8872	270.1098	258.5036	256.7494	265.8355	267.5016	276.0557	287.2891	316.4057 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	40.7560	32.6960	29.4391	21.5683	16.6600	13.6114	15.1978	19.7547	25.6594	33.6665	38.0263	41.8887 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-45.5966	-65.8039	-96.7474	-111.2650	-121.9974	-114.4774	-112.9751	-105.6343	-93.0642	-76.2886	-50.6336	-39.2378 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233b)m	-21.3025	-45.2705	-90.8736	-137.8382	-183.6387	-185.1271	-183.0453	-154.4232	-112.3847	-65.2899	-28.6092	-16.8184	(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												6331.3119	(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												3376.9739	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												328.9243	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2258.3427	(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												7864.8674	(238)

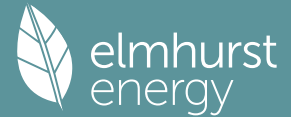
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6331.3119	0.2100	1329.5755 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3376.9739	0.2100	709.1645 (264)
Space and water heating			2038.7400 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	328.9243	0.1443	47.4739 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1033.7215	0.1341	-138.6569
PV Unit electricity exported	-1224.6212	0.1256	-153.8037
Total			-292.4606 (269)
Total CO2, kg/year			1805.6826 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.8800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	6331.3119	1.1300	7154.3824 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3376.9739	1.1300	3815.9805 (278)
Space and water heating			10970.3630 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	328.9243	1.5338	504.5150 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1033.7215	1.4957	-1546.1479
PV Unit electricity exported	-1224.6212	0.4610	-564.5461
Total			-2110.6940 (283)
Total Primary energy kWh/year			9494.2848 (286)
Target Primary Energy Rate (TPER)			51.9500 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 5 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	86 B	DER	12.72	TER	9.88
Environmental	87 B	% DER < TER			-28.74
CO ₂ Emissions (t/year)	2.2	DFEE	35.42	TFEE	36.78
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	-36.18	DPER	70.75	TPER	51.95
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	182.7600 (1b)	x 2.7900 (2b)	= 509.9004 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.7600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 509.9004 (5)
Dwelling volume			

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	4 * 10 = 40.0000 (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) =	40.0000 / (5) = 0.0784 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.2284 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2284 (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	0.2913	0.2856	0.2798	0.2513	0.2456	0.2170	0.2170	0.2113	0.2284	0.2456	0.2570	0.2684 (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	0.5424	0.5408	0.5392	0.5316	0.5302	0.5235	0.5235	0.5223	0.5261	0.5302	0.5330	0.5360 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			23.0800	1.1450	26.4275		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	111.0400	23.0800	87.9600	0.1800	15.8328	70.0000	6157.2000 (29a)
HALLWAY	35.9400	2.9100	33.0300	0.1700	5.6151	70.0000	2312.1000 (29a)
Flat Roof	124.1700		124.1700	0.1100	13.6587	9.0000	1117.5300 (30)
Total net area of external elements A _{um} (A, m ²)			271.1500				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	65.0261		(33)
Party Wall 1	32.1700	0.0000	0.0000	180.0000 5790.6000 (32)
Party Floor 1	182.7600			40.0000 7310.4000 (32d)
Party Ceiling 1	58.5900			40.0000 2343.6000 (32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25031.4300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		136.9634	(35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.3000	3.9900
E3 Sill	6.7500	0.0400	0.2700
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	52.6800	0.0700	3.6876
E14 Flat roof	40.9200	0.0400	1.6368
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	8.3700	0.0600	0.5022

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.0762	(36)
Point Thermal bridges		0.0000	(36a) =
Total fabric heat loss	(33) + (36) + (36a) =	77.1023	(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	91.2713	90.9941	90.7224	89.4464	89.2076	88.0962	88.0962	87.8904	88.5243	89.2076	89.6906	90.1955
Average = Sum(39)m / 12 =	168.3736	168.0964	167.8247	166.5487	166.3099	165.1985	165.1985	164.9927	165.6266	166.3099	166.7929	167.2978
												166.5475

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9213	0.9198	0.9183	0.9113	0.9100	0.9039	0.9039	0.9028	0.9063	0.9100	0.9126	0.9154
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9794	(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	32.0210	31.5454	30.8757	29.6410	28.7164	27.6912	27.1374	27.8024	28.5264	29.6235	30.8837	31.9127	31.9127	(42b)
Hot water usage for other uses	45.1424	43.5008	41.8593	40.2178	38.5762	36.9347	36.9347	38.5762	40.2178	41.8593	43.5008	45.1424	45.1424	(42c)
Average daily hot water use (litres/day)													70.7270	(43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	77.1634	75.0463	72.7350	69.8587	67.2926	64.6258	64.0721	66.3786	68.7442	71.4828	74.3845	77.0551	
Energy content (annual)	122.2079	106.8649	111.7910	95.6331	90.5888	79.4650	77.4896	82.1906	84.7685	97.0014	105.9744	120.6497	
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	
Total = Sum(45)m =													1174.6248

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	0.0000	(46)

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	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	0.0000	(59)
Total heat required for water heating calculated for each month														

WWHRS	103.8767	90.8351	95.0224	81.2881	77.0004	67.5452	65.8662	69.8620	72.0532	82.4512	90.0782	102.5522	102.5522	(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	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	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	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

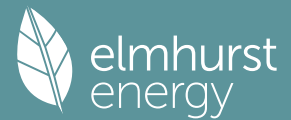
Total per year (kWh/year)														
Electric shower(s)	59.4019	52.9276	57.7949	55.1530	56.1879	53.5978	55.3844	56.1879	55.1530	57.7949	56.7082	59.4019	59.4019	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													675.6937	(64a)

Heat gains from water heating, kWh/month	40.8197	35.9407	38.2043	34.1103	33.2971	30.2858	30.3126	31.5125	31.8016	35.0615	36.6966	40.4885	40.4885	(65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	196.1495	217.1656	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495	202.6879	196.1495	202.6879	196.1495
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	354.3504	358.0274	348.7614	329.0351	304.1342	280.7308	265.0959	261.4189	270.6849	290.4112	315.3122	338.7155
Pumps, fans	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972

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Losses e.g. evaporation (negative values) (Table 5)

Water heating gains (Table 5)	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	(71)
Total internal gains	54.8651	53.4832	51.3499	47.3754	44.7542	42.0636	40.7428	42.3555	44.1688	47.1257	50.9675	54.4201	(72)
	673.0566	696.3677	663.9523	646.7898	612.7294	593.1737	569.6798	567.6154	585.2331	601.3780	636.6590	656.9766	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610	(74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047	(78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972	(80)

Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355	(83)
Total gains	790.9195	915.6965	1011.8669	1155.5875	1251.7953	1257.5727	1197.8003	1094.2822	988.3525	856.8206	781.2486	755.6121	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, ni1,m (see Table 9a)	41.2961	41.3642	41.4312	41.7486	41.8085	42.0898	42.0898	42.1423	41.9810	41.8085	41.6875	41.5617	
tau	3.7531	3.7576	3.7621	3.7832	3.7872	3.8060	3.8060	3.8095	3.7987	3.7872	3.7792	3.7708	
util living area	0.9938	0.9887	0.9781	0.9441	0.8656	0.7184	0.5676	0.6299	0.8449	0.9634	0.9891	0.9948	(86)
MIT	19.0226	19.2412	19.5895	20.0950	20.5464	20.8490	20.9539	20.9316	20.6982	20.1144	19.4873	18.9867	(87)
Th 2	20.1494	20.1507	20.1520	20.1579	20.1590	20.1642	20.1642	20.1651	20.1622	20.1590	20.1568	20.1544	(88)
util rest of house	0.9926	0.9865	0.9737	0.9318	0.8346	0.6543	0.4742	0.5373	0.7978	0.9532	0.9866	0.9938	(89)
MIT 2	18.3109	18.5294	18.8761	19.3764	19.8044	20.0696	20.1438	20.1325	19.9508	19.4019	18.7798	18.2787	(90)
Living area fraction	18.4651	18.6836	19.0307	19.5321	19.9652	20.2385	20.3194	20.3056	20.1128	19.5563	18.9331	18.4321	(92)
MIT	18.4651	18.6836	19.0307	19.5321	19.9652	20.2385	20.3194	20.3056	20.1128	19.5563	18.9331	18.4321	(93)
Temperature adjustment	18.4651	18.6836	19.0307	19.5321	19.9652	20.2385	20.3194	20.3056	20.1128	19.5563	18.9331	18.4321	(93)
adjusted MIT	18.4651	18.6836	19.0307	19.5321	19.9652	20.2385	20.3194	20.3056	20.1128	19.5563	18.9331	18.4321	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9893	0.9813	0.9659	0.9206	0.8264	0.6605	0.4924	0.5539	0.7946	0.9437	0.9816	0.9910	(94)	
Useful gains	782.4790	898.5698	977.3164	1063.7990	1034.5093	830.5660	589.8529	606.1656	785.3465	808.5782	766.8574	748.7772	(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	2385.0332	2316.9737	2102.9581	1770.7615	1374.5799	931.4687	614.4315	644.4017	995.8736	1489.5149	1973.6710	2381.0043	(97)	
Space heating kWh	1192.3003	953.1674	837.4774	509.0130	253.0125	0.0000	0.0000	0.0000	0.0000	506.6169	868.9058	1214.3770	(98a)	
Space heating requirement - total per year (kWh/year)												6334.8703		
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	1192.3003	953.1674	837.4774	509.0130	253.0125	0.0000	0.0000	0.0000	0.0000	506.6169	868.9058	1214.3770	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												6334.8703		
Space heating per m2												(98c) / (4) =	34.6622	(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	1552.8659	1222.4689	1253.9444	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7398	0.8168	0.7700	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1148.7427	998.5710	965.5944	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1370.2421	1304.5645	1187.6670	0.0000	0.0000	0.0000	0.0000	(103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	159.4795	227.6592	165.2220	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	39.8699	56.9148	41.3055	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling requirement													138.0902	(107)
Energy for space heating													34.6622	(99)
Energy for space cooling													0.7556	(108)
Total													35.4178	(109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	182.7600 (1b)	x 2.7900 (2b)	= 509.9004 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.7600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 509.9004 (5)
Dwelling volume			

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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0784 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3284 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3284 (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	0.4188	0.4106	0.4023	0.3613	0.3531	0.3120	0.3120	0.3038	0.3284	0.3531	0.3695	0.3859 (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	0.5877	0.5843	0.5809	0.5653	0.5623	0.5487	0.5487	0.5462	0.5539	0.5623	0.5683	0.5745 (25)

3. Heat losses and heat loss parameter

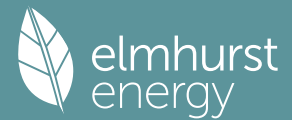
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			23.0800	1.1450	26.4275		(27)
EXTERNAL	111.0400	23.0800	87.9600	0.1800	15.8328		(29a)
HALLWAY	35.9400	2.9100	33.0300	0.1800	5.9454		(29a)
Flat Roof	124.1700		124.1700	0.1100	13.6587		(30)
Total net area of external elements Aum(A, m ²)			271.1500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	64.7744	(33)
Party Wall 1			32.1700	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 136.9634 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.0500	0.6650
E3 Sill	6.7500	0.0500	0.3375
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	52.6800	0.0700	3.6876
E14 Flat roof	40.9200	0.0800	3.2736
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	8.3700	0.0600	0.5022
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.4555 (36)

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Point Thermal bridges													(36a) =	0.0000
Total fabric heat loss													(33) + (36) + (36a) =	75.2299 (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	98.8879	98.3150	97.7534	95.1156	94.6221	92.3247	92.3247	91.8993	93.2097	94.6221	95.6205	96.6643	(38)	
Average = Sum(39) _m / 12 =	174.1178	173.5448	172.9833	170.3455	169.8520	167.5546	167.5546	167.1292	168.4395	169.8520	170.8504	171.8941	(39)	170.3432
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	0.9527	0.9496	0.9465	0.9321	0.9294	0.9168	0.9168	0.9145	0.9216	0.9294	0.9348	0.9405	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		31

4. Water heating energy requirements (kWh/year)

Assumed occupancy														2.9794 (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	32.0210	31.5454	30.8757	29.6410	28.7164	27.6912	27.1374	27.8024	28.5264	29.6235	30.8837	31.9127		(42b)
Hot water usage for other uses	45.1424	43.5008	41.8593	40.2178	38.5762	36.9347	36.9347	38.5762	40.2178	41.8593	43.5008	45.1424	(42c)	45.1424 (42c)
Average daily hot water use (litres/day)														70.7270 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	77.1634	75.0463	72.7350	69.8587	67.2926	64.6258	64.0721	66.3786	68.7442	71.4828	74.3845	77.0551	(44)	
Energy content (annual)	122.2079	106.8649	111.7910	95.6331	90.5888	79.4650	77.4896	82.1906	84.7685	97.0014	105.9744	120.6497	(45)	
Distribution loss (46) _m = 0.15 x (45) _m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	103.8767	90.8351	95.0224	81.2881	77.0004	67.5452	65.8662	69.8620	72.0532	82.4512	90.0782	102.5522	(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	103.8767	90.8351	95.0224	81.2881	77.0004	67.5452	65.8662	69.8620	72.0532	82.4512	90.0782	102.5522	(64)	
12Total per year (kWh/year)														998 (64)
Electric shower(s)	59.4019	52.9276	57.7949	55.1530	56.1879	53.5978	55.3844	56.1879	55.1530	57.7949	56.7082	59.4019	(64a)	
Heat gains from water heating, kWh/month	40.8197	35.9407	38.2043	34.1103	33.2971	30.2858	30.3126	31.5125	31.8016	35.0615	36.6966	40.4885	(65)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a) _m														675.6937 (64a)

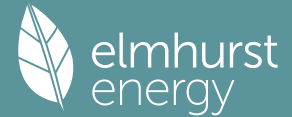
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66) _m	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	196.1495	217.1656	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495	202.6879	196.1495	202.6879	196.1495	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3504	358.0274	348.7614	329.0351	304.1342	280.7308	265.0959	261.4189	270.6849	290.4112	315.3122	338.7155	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	(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)	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	(71)	
Water heating gains (Table 5)	54.8651	53.4832	51.3499	47.3754	44.7542	42.0636	40.7428	42.3555	44.1688	47.1257	50.9675	54.4201	(72)	
Total internal gains	673.0566	696.3677	663.9523	646.7898	612.7294	593.1737	569.6798	567.6154	585.2331	601.3780	636.6590	656.9766	(73)	

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m ²	Table 6a	Specific data	Specific data	factor	W
		W/m ²	or Table 6b	or Table 6c	Table 6d	
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610 (74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972 (80)

Full SAP Calculation Printout



Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	790.9195	915.6965	1011.8669	1155.5875	1251.7953	1257.5727	1197.8003	1094.2822	988.3525	856.8206	781.2486	755.6121 (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	39.9337	40.0656	40.1957	40.8181	40.9367	41.4980	41.4980	41.6036	41.2799	40.9367	40.6975	40.4503
alpha	3.6622	3.6710	3.6797	3.7212	3.7291	3.7665	3.7665	3.7736	3.7520	3.7291	3.7132	3.6967
util living area	0.9938	0.9887	0.9786	0.9454	0.8693	0.7232	0.5733	0.6349	0.8483	0.9642	0.9891	0.9948 (86)
MIT	18.9485	19.1721	19.5294	20.0576	20.5215	20.8408	20.9506	20.9275	20.6840	20.0844	19.4426	18.9270 (87)
Th 2	20.1229	20.1256	20.1282	20.1403	20.1426	20.1532	20.1532	20.1552	20.1491	20.1426	20.1380	20.1332 (88)
util rest of house	0.9926	0.9865	0.9741	0.9333	0.8385	0.6587	0.4784	0.5412	0.8014	0.9540	0.9866	0.9938 (89)
MIT 2	18.2182	18.4426	18.7993	19.3267	19.7684	20.0534	20.1314	20.1207	19.9278	19.3603	18.7219	18.2040 (90)
Living area fraction									f _{LA} = Living area / (4) =			
MIT	18.3764	18.6007	18.9575	19.4851	19.9316	20.2240	20.3089	20.2955	20.0916	19.5172	18.8780	18.3607 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3764	18.6007	18.9575	19.4851	19.9316	20.2240	20.3089	20.2955	20.0916	19.5172	18.8780	18.3607 (93)

8. Space heating requirement

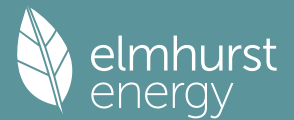
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9892	0.9813	0.9662	0.9219	0.8298	0.6646	0.4968	0.5579	0.7977	0.9443	0.9816	0.9908 (94)
Useful gains	782.3641	898.5443	977.6306	1065.2807	1038.7353	835.7310	595.0363	610.4850	788.4404	809.1270	766.8378	748.6845 (95)
Ext temp.	4.3000	4.9000	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	2450.9510	2377.6814	2154.9403	1803.1232	1398.1495	942.3336	621.4470	651.0499	1009.2242	1514.6008	2012.2830	2434.1377 (97)
Space heating kWh	1241.4287	993.9801	875.9184	531.2466	267.4042	0.0000	0.0000	0.0000	0.0000	524.8725	896.7205	1253.9772 (98a)
Space heating requirement - total per year (kWh/year)												6585.5482
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	1241.4287	993.9801	875.9184	531.2466	267.4042	0.0000	0.0000	0.0000	0.0000	524.8725	896.7205	1253.9772 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6585.5482
Space heating per m ²												(98c) / (4) = 36.0339 (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	1575.0135	1239.9042	1270.1818	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7320	0.8098	0.7632	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1152.9285	1004.0775	969.3768	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1370.2421	1304.5645	1187.6670	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	156.4658	223.5623	162.4079	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									f _C = 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	39.1164	55.8906	40.6020	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												135.6090 (107)
Energy for space heating												36.0339 (99)
Energy for space cooling												0.7420 (108)
Total												36.7759 (109)
Fabric Energy Efficiency (TFEE)												36.8 (109)

Predicted Energy Assessment

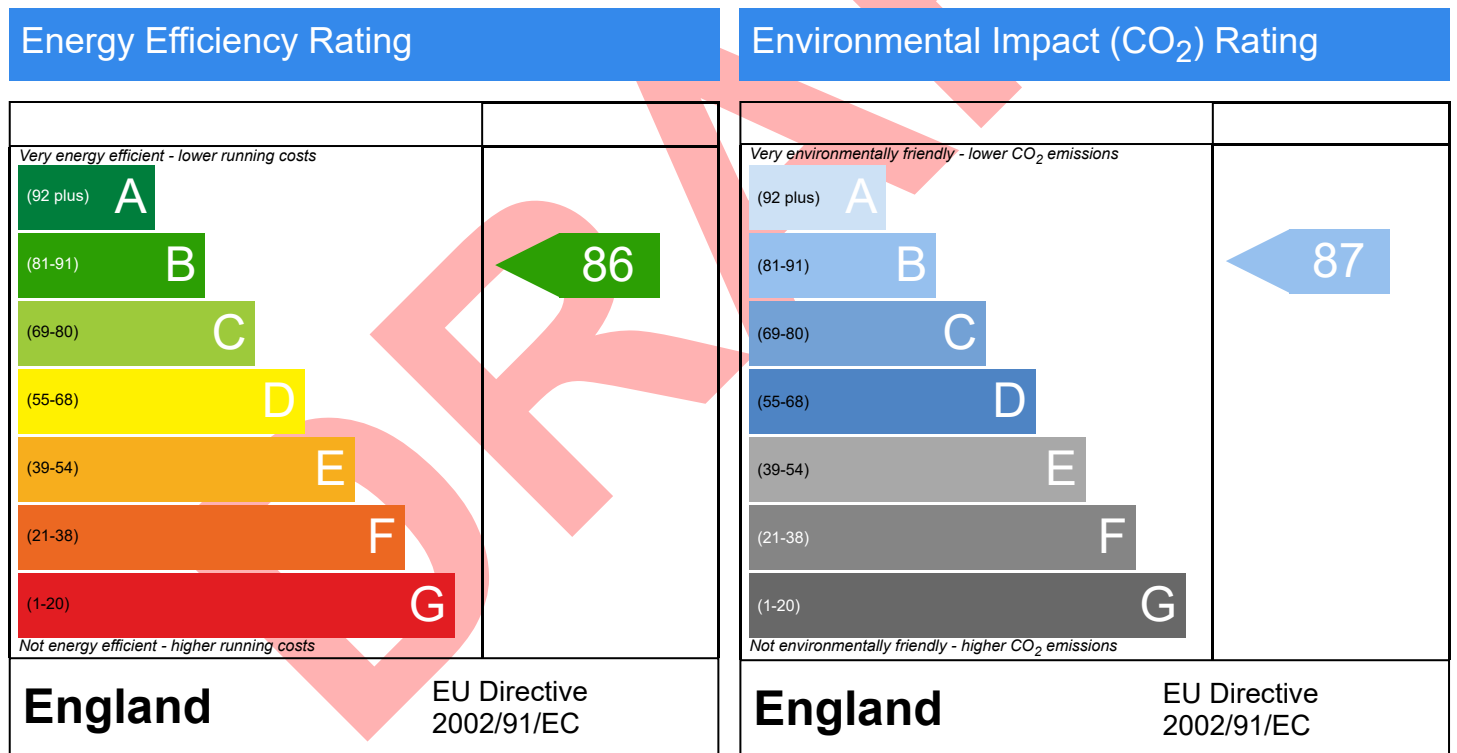


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Semi-Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 182.76 m²
 DRRN:

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.

Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Semi-Detached
Floor Area [m ²]	183

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

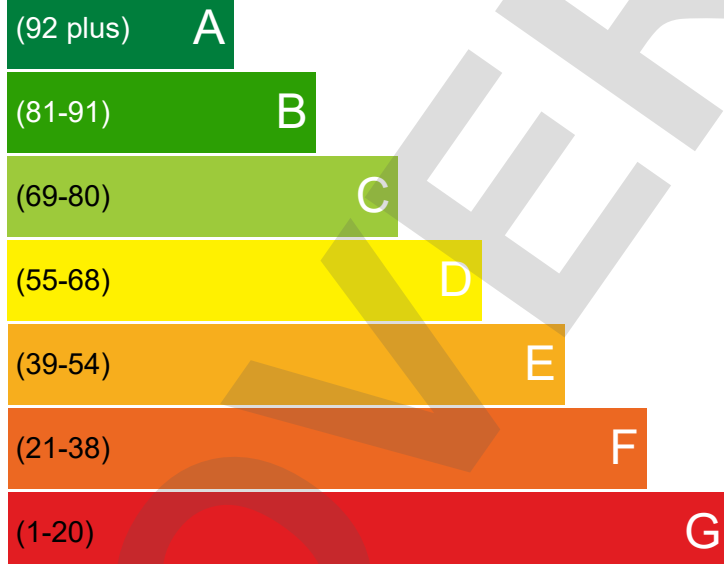
Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL



86

86

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excelent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 67 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **2.2** per year

With the recommended measures the potential CO emissions could be: **2** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£700

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:05

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Semi-detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	183 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 5 - Heatpump + PV
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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	9.88 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	1.7 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	51.95 kWh _{PE} /m ²		
Dwelling primary energy	17.35 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	36.8 kWh/m ²		
Dwelling fabric energy efficiency	35.4 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	WEST (1.2)	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)	87.96	0.18
Sheltered wall: Walls (2)	33.03	0.18
Party wall: Party Wall (1)	32.17	0 (!)
Exposed roof: Roof (1)	124.17	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
WEST, Windows	7.43	West	0.7	1.2
ENTRANCE DOOR, Entrance Door	2.91	East	N/A	1.2
SOUTH, Windows	2.03	South	0.7	1.2
NORTH, Windows	13.62	North	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	

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		3 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	415.9%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	MIDEA
Model	MHC-V16W/D2N8-B
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

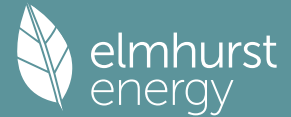
5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	500 litres
Declared heat loss	2.1 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	1.79 kWp	
Orientation	South	
Pitch	30°	
Overshading	None or very little	
Manufacturer	PV	
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 5 - Heatpump + PV	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	92 A	DER	1.70	TER	9.88
Environmental	98 A	% DER < TER			82.79
CO ₂ Emissions (t/year)	0.29	DFEE	35.42	TFEE	36.78
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	66.59	DPER	17.35	TPER	51.95

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	Flat, Semi-Detached	
Position of Flat	Mid-floor flat	
Which Floor	1	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	182.76 m ²	2.79 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	39.60	m ²
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9.0 External Walls	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
	EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	111.04	87.96	0.00	None	23.08	Enter Gross Area
	HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	35.94	33.03	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
	Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	32.17	0.00	None

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	124.17	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	58.59

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	182.76

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
WEST	Windows	EXTERNAL	West	7.43	0
ENTRANCE DOOR	Entrance Door	HALLWAY	East	2.91	0
SOUTH	Windows	EXTERNAL	South	2.03	0
NORTH	Windows	EXTERNAL	North	13.62	0

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	13.30	0.30	0.30	No
E3 Sill	Independently assessed	6.75	0.04	0.04	No
E4 Jamb	Independently assessed	33.00	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	52.68	0.07	0.07	No
E14 Flat roof	Independently assessed	40.92	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.74	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	16.74	-0.09	-0.09	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	11.53	0.00	0.00	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	2.83	0.12	0.12	No
E18 Party wall between dwellings	Independently assessed	8.37	0.06	0.06	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m²/(h.m²) @ 50 Pa

Property Tested?

Test Method

As Built AP₅₀ m²/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

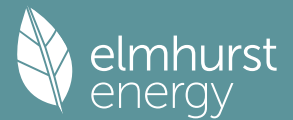
MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

20.0 Fans, Open Fireplaces, Flues

Summary for Input Data



21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

SAP Code

In Winter

In Summer

Model Name

Manufacturer

System Type

Controls SAP Code

Delayed Start Stat

Burner Control

HETAS approved System

Oil Pump Inside

FI Case

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heating Pump Age

Heat Emitter

Underfloor Heating

Flow Temperature

Flow Temperature Value

Boiler Interlock

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

26.0 Heat Networks

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

28.0 Water Heating

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

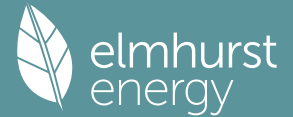
Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

Summary for Input Data



Summer Immersion	No
Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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
Independent Time Control	Yes
Insulation Type	Measured Loss
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Loss	2.10 kWh/day
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

None

32.0 Photovoltaic Unit

One Dwelling								
Export Capable Meter?	No							
Connected To Dwelling	Yes							
Diverter	No							
Battery Capacity [kWh]	0.00							
PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
1.79	South	30°	None Or Little	No	No	1.00		PV

34.0 Small-scale Hydro

None											
Electricity Generated	0.00										
Apportioned	0.00 kWh/Year										
Connected to dwelling's electricity meter	Yes										
Electricity Generation	Annual										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

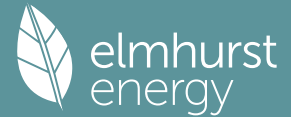
Lower cost measures

None

Further measures to achieve even higher standards

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

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 5 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	92 A	DER	1.70	TER	9.88
Environmental	98 A	% DER < TER			82.79
CO ₂ Emissions (t/year)	0.29	DFEE	35.42	TFEE	36.78
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	66.59	DPER	17.35	TPER	51.95
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	182.7600 (1b)	x 2.7900 (2b)	= 509.9004 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.7600		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 509.9004 (5)

2. Ventilation rate

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

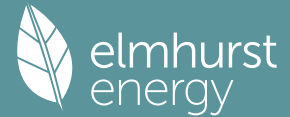
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			23.0800	1.1450	26.4275		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	111.0400	23.0800	87.9600	0.1800	15.8328	70.0000	6157.2000 (29a)
HALLWAY	35.9400	2.9100	33.0300	0.1700	5.6151	70.0000	2312.1000 (29a)

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Flat Roof	124.1700	124.1700	0.1100	13.6587	9.0000	1117.5300 (30)
Total net area of external elements Aum(A, m2)		271.1500				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	65.0261			(33)
Party Wall 1		32.1700	0.0000	0.0000	180.0000	5790.6000 (32)
Party Floor 1		182.7600			40.0000	7310.4000 (32d)
Party Ceiling 1		58.5900			30.0000	1757.7000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24445.5300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 133.7576 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	13.3000	0.3000	3.9900
E3 Sill	6.7500	0.0400	0.2700
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	52.6800	0.0700	3.6876
E14 Flat roof	40.9200	0.0400	1.6368
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	8.3700	0.0600	0.5022

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.0762 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 77.1023 (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	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336	84.1336 (38)
Heat transfer coeff												
	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358	161.2358 (39)
Average = Sum(39)m / 12 =												161.2358

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822	0.8822 (40)
HLP (average)												0.8822
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9794 (42)
Hot water usage for mixer showers													
74.1752	73.0605	71.4361	68.3282	66.0347	63.4769	62.0231	63.6351	65.4023	68.1485	71.3232	73.8910	73.8910 (42a)	
Hot water usage for baths													
33.7063	33.2057	32.5008	31.2010	30.2278	29.1486	28.5657	29.2657	30.0278	31.1826	32.5091	33.5923	33.5923 (42b)	
Hot water usage for other uses													
47.5183	45.7904	44.0624	42.3345	40.6065	38.8786	38.8786	40.6065	42.3345	44.0624	45.7904	47.5183	47.5183 (42c)	
Average daily hot water use (litres/day)													142.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	155.3998	152.0565	147.9993	141.8637	136.8690	131.5041	129.4674	133.5074	137.7646	143.3935	149.6226	155.0016 (44)
Energy conte	246.1152	216.5265	227.4694	194.2043	184.2519	161.6996	156.5796	165.3100	169.8775	194.5836	213.1649	242.6951 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
36.9173	32.4790	34.1204	29.1306	27.6378	24.2549	23.4869	24.7965	25.4816	29.1875	31.9747	36.4043 (46)	

Water storage loss:

Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1340 (55)

Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (56)
If cylinder contains dedicated solar storage												
35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month												
304.5316	269.2897	285.8858	250.7363	242.6683	218.2316	214.9960	223.7264	226.4095	253.0000	269.6969	301.1115 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	304.5316	269.2897	285.8858	250.7363	242.6683	218.2316	214.9960	223.7264	226.4095	253.0000	269.6969	301.1115 (64)
Total per year (kWh/year) = Sum(64)m =												3060.2837 (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	128.5664	114.2056	122.3667	109.7985	107.9969	98.9907	98.7958	101.6987	101.7099	111.4322	116.1029	127.4292 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	196.1495	217.1656	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495	202.6879	196.1495	202.6879	196.1495	202.6879	196.1495	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	354.3504	358.0274	348.7614	329.0351	304.1342	280.7308	265.0959	261.4189	270.6849	290.4112	315.3122	338.7155	338.7155	338.7155	(68)
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	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	(71)
Water heating gains (Table 5)	172.8043	169.9488	164.4714	152.4980	145.1571	137.4871	132.7901	136.6918	141.2637	149.7744	161.2541	171.2758	171.2758	171.2758	(72)
Total internal gains	790.9958	812.8333	777.0738	751.9124	713.1323	688.5973	661.7271	661.9517	682.3280	704.0267	746.9456	773.8324	773.8324	773.8324	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.6300	0.7000	0.7700	44.2610 (74)
South	2.0300	46.7521	0.6300	0.6300	0.7000	0.7700	29.0047 (78)
West	7.4300	19.6403	0.6300	0.6300	0.7000	0.7700	44.5972 (80)

Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355	98.6355	(83)
Total gains	908.8587	1032.1622	1124.9883	1260.7101	1352.1982	1352.9963	1289.8476	1188.6185	1085.4474	959.4693	891.5352	872.4679	872.4679	(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	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149	42.1149
alpha	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077	3.8077
util living area	0.9893	0.9818	0.9670	0.9235	0.8308	0.6741	0.5231	0.5805	0.8016	0.9452	0.9818	0.9909	0.9909 (86)
Living	19.5672	19.7262	19.9768	20.3261	20.6356	20.8286	20.8928	20.8801	20.7363	20.3386	19.8895	19.5289	19.5289
Non living	18.4699	18.6723	18.9903	19.4267	19.7975	20.0068	20.0639	20.0551	19.9176	19.4485	18.8818	18.4211	18.4211
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	10
MIT	20.2670	19.7262	19.9768	20.3261	20.6356	20.8286	20.8928	20.8801	20.7363	20.3386	19.8895	19.7347	19.7347 (87)
Th 2	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826	20.1826 (88)
util rest of house	0.9874	0.9785	0.9607	0.9083	0.7965	0.6104	0.4360	0.4926	0.7501	0.9313	0.9779	0.9892	0.9892 (89)
MIT 2	19.4998	18.6723	18.9903	19.4267	19.7975	20.0068	20.0639	20.0551	19.9176	19.4485	18.8818	18.7385	18.7385 (90)
Living area fraction									fLA = Living area / (4) =				0.2167 (91)
MIT	19.6661	18.9007	19.2041	19.6216	19.9791	20.1849	20.2435	20.2338	20.0950	19.6414	19.1001	18.9544	18.9544 (92)
Temperature adjustment												0.0000	0.0000
adjusted MIT	19.6661	18.9007	19.2041	19.6216	19.9791	20.1849	20.2435	20.2338	20.0950	19.6414	19.1001	18.9544	18.9544 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9718	0.9512	0.8958	0.7869	0.6105	0.4427	0.4984	0.7438	0.9197	0.9711	0.9860	0.9860 (94)
Useful gains	896.1182	1003.0222	1070.1338	1129.3254	1063.9990	826.0682	571.0742	592.4326	807.3560	882.4618	865.7603	860.2472	860.2472 (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	4.2000 (96)
Heat loss rate W	2477.5591	2257.4091	2048.3502	1728.7052	1334.8889	900.4821	587.4609	618.1520	966.6022	1457.7977	1934.8481	2378.9305	2378.9305 (97)
Space heating kWh	1176.5920	842.9480	727.7930	431.5535	201.5421	0.0000	0.0000	0.0000	0.0000	428.0499	769.7432	1129.9004	1129.9004 (98a)
Space heating requirement - total per year (kWh/year)												5708.1222	5708.1222
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	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000	0.0000
Space heating kWh	1176.5920	842.9480	727.7930	431.5535	201.5421	0.0000	0.0000	0.0000	0.0000	428.0499	769.7432	1129.9004	1129.9004 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5708.1222	5708.1222
Space heating per m2												(98c) / (4) =	31.2329 (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 %)													415.9001 (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													

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Space heating efficiency (main heating system 1)	1176.5920	842.9480	727.7930	431.5535	201.5421	0.0000	0.0000	0.0000	0.0000	428.0499	769.7432	1129.9004	(98)
Space heating fuel (main heating system)	415.9001	415.9001	415.9001	415.9001	415.9001	0.0000	0.0000	0.0000	0.0000	415.9001	415.9001	415.9001	(210)
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 (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	304.5316	269.2897	285.8858	250.7363	242.6683	218.2316	214.9960	223.7264	226.4095	253.0000	269.6969	301.1115	(64)
Efficiency of water heater (217)m	285.1116	285.1116	285.1116	285.1116	285.1116	285.1116	285.1116	285.1116	285.1116	285.1116	285.1116	285.1116	(216)
Fuel for water heating, kWh/month	106.8114	94.4506	100.2715	87.9432	85.1134	76.5425	75.4076	78.4698	79.4108	88.7372	94.5934	105.6118	(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 Fans	13.3142	12.0257	13.3142	12.8847	13.3142	12.8847	13.3142	13.3142	12.8847	13.3142	12.8847	13.3142	(231)
Lighting	37.9237	30.4238	27.3933	20.0695	15.5022	12.6655	14.1417	18.3819	23.8762	31.3269	35.3837	38.9777	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-35.6906	-54.1052	-83.4310	-99.2934	-110.2897	-101.5016	-100.1293	-91.9942	-78.2263	-63.4777	-40.2566	-30.3534	(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												1372.4745	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												285.1116	
Water heating fuel used												1073.3633	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)													
mechanical ventilation fans (SFP = 0.2520)												156.7638	(230a)
Total electricity for the above, kWh/year												156.7638	(231)
Electricity for lighting (calculated in Appendix L)												306.0659	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-888.7489	(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												2019.9186	(238)

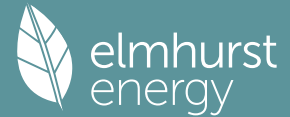
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1372.4745	0.1550	212.7780 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1073.3633	0.1409	151.2734 (264)
Space and water heating			364.0515 (265)
Pumps, fans and electric keep-hot	156.7638	0.1387	21.7451 (267)
Energy for lighting	306.0659	0.1443	44.1748 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-888.7489	0.1337	-118.7973
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-118.7973 (269)
Total CO2, kg/year			311.1740 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7000 (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	1372.4745	1.5739	2160.2001 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1073.3633	1.5211	1632.7194 (278)
Space and water heating			3792.9195 (279)

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Pumps, fans and electric keep-hot	156.7638	1.5128	237.1522 (281)
Energy for lighting	306.0659	1.5338	469.4541 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-888.7489	1.4940	-1327.7662
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1327.7662 (283)
Total Primary energy kWh/year			3171.7596 (286)
Dwelling Primary energy Rate (DPER)			17.3500 (287)

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

 1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	182.7600 (1b)	x 2.7900 (2b)	= 509.9004 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	509.9004 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0784 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3284 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3284 (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	0.4188	0.4106	0.4023	0.3613	0.3531	0.3120	0.3120	0.3038	0.3284	0.3531	0.3695	0.3859 (22b)
Effective ac	0.5877	0.5843	0.5809	0.5653	0.5623	0.5487	0.5487	0.5462	0.5539	0.5623	0.5683	0.5745 (25)

 3. Heat losses and heat loss parameter

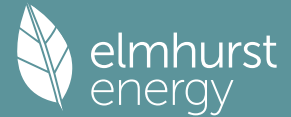
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			23.0800	1.1450	26.4275		(27)
EXTERNAL	111.0400	23.0800	87.9600	0.1800	15.8328		(29a)
HALLWAY	35.9400	2.9100	33.0300	0.1800	5.9454		(29a)
Flat Roof	124.1700		124.1700	0.1100	13.6587		(30)
Total net area of external elements Aum(A, m ²)			271.1500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.7744		(33)
Party Wall 1			32.1700	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 136.9634 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.0500	0.6650
E3 Sill	6.7500	0.0500	0.3375
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	52.6800	0.0700	3.6876
E14 Flat roof	40.9200	0.0800	3.2736

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E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	8.3700	0.0600	0.5022
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.4555 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss		(33) + (36) + (36a) =	75.2299 (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	98.8879	98.3150	97.7534	95.1156	94.6221	92.3247	92.3247	91.8993	93.2097	94.6221	95.6205	96.6643 (38)
Average = Sum(39)m / 12 =	174.1178	173.5448	172.9833	170.3455	169.8520	167.5546	167.5546	167.1292	168.4395	169.8520	170.8504	171.8941 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9527	0.9496	0.9465	0.9321	0.9294	0.9168	0.9168	0.9145	0.9216	0.9294	0.9348	0.9405 (40)
HLP (average)												0.9321
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

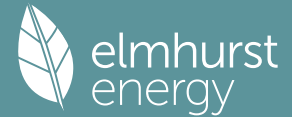
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9794 (42)
Hot water usage for mixer showers	74.1752	73.0605	71.4361	68.3282	66.0347	63.4769	62.0231	63.6351	65.4023	68.1485	71.3232	73.8910 (42a)	
Hot water usage for baths	32.0210	31.5454	30.8757	29.6410	28.7164	27.6912	27.1374	27.8024	28.5264	29.6235	30.8837	31.9127 (42b)	
Hot water usage for other uses	45.1424	43.5008	41.8593	40.2178	38.5762	36.9347	36.9347	38.5762	40.2178	41.8593	43.5008	45.1424 (42c)	
Average daily hot water use (litres/day)	35.9525	31.6353	33.2379	28.3757	26.9226	23.6276	22.8752	24.1476	24.8124	28.4217	31.1381	35.4518 (43)	
Daily hot water use	151.3385	148.1067	144.1711	138.1869	133.3273	128.1027	126.0952	130.0137	134.1465	139.6313	145.7077	150.9461 (44)	
Energy conte	239.6832	210.9020	221.5857	189.1710	179.4841	157.5173	152.5012	160.9842	165.4160	189.4783	207.5873	236.3451 (45)	
Energy content (annual)													Total = Sum(45)m = 2310.6553
Distribution loss (46)m = 0.15 x (45)m	35.9525	31.6353	33.2379	28.3757	26.9226	23.6276	22.8752	24.1476	24.8124	28.4217	31.1381	35.4518 (46)	
Water storage loss:													500.0000 (47)
Store volume													2.9009 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.5665 (55)
Enter (49) or (54) in (55)													
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (56)	
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (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	311.5063	275.7745	293.4088	258.6772	251.3072	227.0235	224.3243	232.8073	234.9222	261.3014	277.0935	308.1682 (62)	
WVHRS	-33.9098	-29.9901	-31.4039	-26.0037	-24.2345	-20.7376	-19.4382	-20.6706	-21.4559	-25.2942	-28.6553	-33.2818 (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	277.5966	245.7844	262.0049	232.6736	227.0727	206.2859	204.8861	212.1367	213.4663	236.0072	248.4383	274.8864 (64)	
													Total per year (kWh/year) = Sum(64)m = 2841.2390 (64)
													2841 (64)
12Total per year (kWh/year)													
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	137.1532	122.0229	131.1357	118.5043	117.1370	107.9795	108.1651	110.9857	110.6058	120.4600	124.6278	136.0432 (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	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	196.1495	217.1656	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495	202.6879	196.1495	202.6879	196.1495 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3504	358.0274	348.7614	329.0351	304.1342	280.7308	265.0959	261.4189	270.6849	290.4112	315.3122	338.7155 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774 (71)
Water heating gains (Table 5)	184.3457	181.5817	176.2577	164.5894	157.4421	149.9715	145.3832	149.1744	153.6192	161.9086	173.0941	182.8538 (72)
Total internal gains	805.5371	827.4662	791.8601	767.0038	728.4174	701.0817	674.3202	674.4343	694.6835	719.1609	761.7856	788.4104 (73)

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6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North		13.6200	10.6334	0.6300	0.7000	0.7700	44.2610 (74)					
South		2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)					
West		7.4300	19.6403	0.6300	0.7000	0.7700	44.5972 (80)					
Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	923.4000	1046.7951	1139.7747	1275.8015	1367.4832	1365.4807	1302.4408	1201.1010	1097.8029	974.6035	906.3752	887.0458 (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	39.9337	40.0656	40.1957	40.8181	40.9367	41.4980	41.4980	41.6036	41.2799	40.9367	40.6975	40.4503
alpha	3.6622	3.6710	3.6797	3.7212	3.7291	3.7665	3.7665	3.7736	3.7520	3.7291	3.7132	3.6967
util living area	0.9897	0.9828	0.9693	0.9287	0.8414	0.6861	0.5352	0.5915	0.8115	0.9481	0.9825	0.9911 (86)
MIT	19.0721	19.2916	19.6404	20.1473	20.5822	20.8676	20.9607	20.9430	20.7351	20.1797	19.5571	19.0507 (87)
Th 2	20.1229	20.1256	20.1282	20.1403	20.1426	20.1532	20.1532	20.1552	20.1491	20.1426	20.1380	20.1332 (88)
util rest of house	0.9878	0.9796	0.9632	0.9136	0.8069	0.6204	0.4438	0.5000	0.7592	0.9342	0.9787	0.9895 (89)
MIT 2	17.8364	18.1175	18.5624	19.2051	19.7295	20.0488	20.1315	20.1212	19.9168	19.2551	18.4658	17.8156 (90)
Living area fraction	18.1042	18.3719	18.7960	19.4093	19.9142	20.2262	20.3112	20.2993	20.0941	19.4554	18.7023	18.0832 (92)
MIT	18.1042	18.3719	18.7960	19.4093	19.9142	20.2262	20.3112	20.2993	20.0941	19.4554	18.7023	18.0832 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1042	18.3719	18.7960	19.4093	19.9142	20.2262	20.3112	20.2993	20.0941	19.4554	18.7023	18.0832 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9813	0.9704	0.9506	0.8979	0.7964	0.6265	0.4616	0.5165	0.7553	0.9199	0.9695	0.9837 (94)
Useful gains	906.0873	1015.8072	1083.4695	1145.5642	1089.0414	855.4869	601.1480	620.3172	829.1969	896.5529	878.7699	872.5436 (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	2403.5480	2337.9837	2126.9936	1790.2057	1395.2063	942.6968	621.8209	651.6801	1009.6488	1504.1135	1982.2532	2386.4468 (97)
Space heating kWh	1114.1107	888.5026	776.3819	464.1419	227.7867	0.0000	0.0000	0.0000	0.0000	452.0251	794.5079	1126.3440 (98a)
Space heating requirement - total per year (kWh/year)												5843.8009
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	1114.1107	888.5026	776.3819	464.1419	227.7867	0.0000	0.0000	0.0000	0.0000	452.0251	794.5079	1126.3440 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5843.8009
Space heating per m2												(98c) / (4) = 31.9753 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 92.3000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1114.1107	888.5026	776.3819	464.1419	227.7867	0.0000	0.0000	0.0000	0.0000	452.0251	794.5079	1126.3440 (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)	1207.0538	962.6247	841.1505	502.8623	246.7895	0.0000	0.0000	0.0000	0.0000	489.7346	860.7886	1220.3077 (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	277.5966	245.7844	262.0049	232.6736	227.0727	206.2859	204.8861	212.1367	213.4663	236.0072	248.4383	274.8864 (64)
Efficiency of water heater	86.8463	86.6816	86.3429	85.5772	84.0668	79.8000	79.8000	79.8000	79.8000	85.4926	86.4768	86.8778 (217)
Fuel for water heating, kWh/month	319.6412	283.5484	303.4468	271.8872	270.1098	258.5036	256.7494	265.8355	267.5016	276.0557	287.2891	316.4057 (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)

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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	40.7560	32.6960	29.4391	21.5683	16.6600	13.6114	15.1978	19.7547	25.6594	33.6665	38.0263	41.8887	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-45.5966	-65.8039	-96.7474	-111.2650	-121.9974	-114.4774	-112.9751	-105.6343	-93.0642	-76.2886	-50.6336	-39.2378	(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	-21.3025	-45.2705	-90.8736	-137.8382	-183.6387	-185.1271	-183.0453	-154.4232	-112.3847	-65.2899	-28.6092	-16.8184	(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												6331.3119	(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												3376.9739	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												328.9243	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2258.3427	(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												7864.8674	(238)

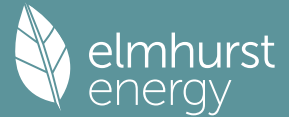
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6331.3119	0.2100	1329.5755 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3376.9739	0.2100	709.1645 (264)
Space and water heating			2038.7400 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	328.9243	0.1443	47.4739 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1033.7215	0.1341	-138.6569
PV Unit electricity exported	-1224.6212	0.1256	-153.8037
Total			-292.4606 (269)
Total CO2, kg/year			1805.6826 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.8800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	6331.3119	1.1300	7154.3824 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3376.9739	1.1300	3815.9805 (278)
Space and water heating			10970.3630 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	328.9243	1.5338	504.5150 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1033.7215	1.4957	-1546.1479
PV Unit electricity exported	-1224.6212	0.4610	-564.5461
Total			-2110.6940 (283)
Total Primary energy kWh/year			9494.2848 (286)
Target Primary Energy Rate (TPER)			51.9500 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 5 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	92 A	DER	1.70	TER	9.88
Environmental	98 A	% DER < TER			82.79
CO ₂ Emissions (t/year)	0.29	DFEE	35.42	TFEE	36.78
Compliance Check	See BREL	% DFEE < TFEE			3.69
% DPER < TPER	66.59	DPER	17.35	TPER	51.95
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	182.7600 (1b)	2.7900 (2b)	509.9004 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.7600		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 509.9004 (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	4 * 10 = 40.0000 (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) =	40.0000 / (5) =	0.0784 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2284 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2284 (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	0.2913	0.2856	0.2798	0.2513	0.2456	0.2170	0.2170	0.2113	0.2284	0.2456	0.2570	0.2684 (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	0.5424	0.5408	0.5392	0.5316	0.5302	0.5235	0.5235	0.5223	0.5261	0.5302	0.5330	0.5360 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			23.0800	1.1450	26.4275		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	111.0400	23.0800	87.9600	0.1800	15.8328	70.0000	6157.2000 (29a)
HALLWAY	35.9400	2.9100	33.0300	0.1700	5.6151	70.0000	2312.1000 (29a)
Flat Roof	124.1700		124.1700	0.1100	13.6587	9.0000	1117.5300 (30)
Total net area of external elements A _{um} (A, m ²)			271.1500				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	65.0261		(33)
Party Wall 1	32.1700	0.0000	0.0000	180.0000 5790.6000 (32)
Party Floor 1	182.7600			40.0000 7310.4000 (32d)
Party Ceiling 1	58.5900			40.0000 2343.6000 (32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25031.4300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		136.9634	(35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.3000	3.9900
E3 Sill	6.7500	0.0400	0.2700
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	52.6800	0.0700	3.6876
E14 Flat roof	40.9200	0.0400	1.6368
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	8.3700	0.0600	0.5022

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.0762	(36)
Point Thermal bridges		0.0000	(36a) =
Total fabric heat loss	(33) + (36) + (36a) =	77.1023	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	91.2713	90.9941	90.7224	89.4464	89.2076	88.0962	88.0962	87.8904	88.5243	89.2076	89.6906	90.1955	
Average = Sum(39)m / 12 =	168.3736	168.0964	167.8247	166.5487	166.3099	165.1985	165.1985	164.9927	165.6266	166.3099	166.7929	167.2978	(39)
													166.5475
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.9213	0.9198	0.9183	0.9113	0.9100	0.9039	0.9039	0.9028	0.9063	0.9100	0.9126	0.9154	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

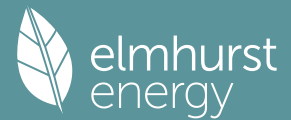
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9794	(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														
	32.0210	31.5454	30.8757	29.6410	28.7164	27.6912	27.1374	27.8024	28.5264	29.6235	30.8837	31.9127		(42b)
Hot water usage for other uses														
	45.1424	43.5008	41.8593	40.2178	38.5762	36.9347	36.9347	38.5762	40.2178	41.8593	43.5008	45.1424		(42c)
Average daily hot water use (litres/day)													70.7270	(43)
Daily hot water use														
	77.1634	75.0463	72.7350	69.8587	67.2926	64.6258	64.0721	66.3786	68.7442	71.4828	74.3845	77.0551		(44)
Energy content (annual)														
	122.2079	106.8649	111.7910	95.6331	90.5888	79.4650	77.4896	82.1906	84.7685	97.0014	105.9744	120.6497		(45)
Distribution loss (46)m = 0.15 x (45)m														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(46)
Water storage loss:														
Total storage loss														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(56)
If cylinder contains dedicated solar storage														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(57)
Primary loss														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(59)
Combi loss														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(61)
Total heat required for water heating calculated for each month														
	103.8767	90.8351	95.0224	81.2881	77.0004	67.5452	65.8662	69.8620	72.0532	82.4512	90.0782	102.5522		(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														
	103.8767	90.8351	95.0224	81.2881	77.0004	67.5452	65.8662	69.8620	72.0532	82.4512	90.0782	102.5522		(64)
Total per year (kWh/year) = Sum(64)m =													998.4311	(64)
12Total per year (kWh/year)													998	(64)
Electric shower(s)														
	59.4019	52.9276	57.7949	55.1530	56.1879	53.5978	55.3844	56.1879	55.1530	57.7949	56.7082	59.4019		(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													675.6937	(64a)
Heat gains from water heating, kWh/month														
	40.8197	35.9407	38.2043	34.1103	33.2971	30.2858	30.3126	31.5125	31.8016	35.0615	36.6966	40.4885		(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	(66)
	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	196.1495	217.1656	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495	202.6879	196.1495	202.6879	196.1495	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	354.3504	358.0274	348.7614	329.0351	304.1342	280.7308	265.0959	261.4189	270.6849	290.4112	315.3122	338.7155	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	
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	

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Losses e.g. evaporation (negative values) (Table 5)

Water heating gains (Table 5)	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	(71)
Total internal gains	54.8651	53.4832	51.3499	47.3754	44.7542	42.0636	40.7428	42.3555	44.1688	47.1257	50.9675	54.4201	(72)
	673.0566	696.3677	663.9523	646.7898	612.7294	593.1737	569.6798	567.6154	585.2331	601.3780	636.6590	656.9766	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610	(74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047	(78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972	(80)

Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355	(83)
Total gains	790.9195	915.6965	1011.8669	1155.5875	1251.7953	1257.5727	1197.8003	1094.2822	988.3525	856.8206	781.2486	755.6121	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, ni1,m (see Table 9a)	41.2961	41.3642	41.4312	41.7486	41.8085	42.0898	42.0898	42.1423	41.9810	41.8085	41.6875	41.5617	
tau	3.7531	3.7576	3.7621	3.7832	3.7872	3.8060	3.8060	3.8095	3.7987	3.7872	3.7792	3.7708	
util living area	0.9938	0.9887	0.9781	0.9441	0.8656	0.7184	0.5676	0.6299	0.8449	0.9634	0.9891	0.9948	(86)
MIT	19.0226	19.2412	19.5895	20.0950	20.5464	20.8490	20.9539	20.9316	20.6982	20.1144	19.4873	18.9867	(87)
Th 2	20.1494	20.1507	20.1520	20.1579	20.1590	20.1642	20.1642	20.1651	20.1622	20.1590	20.1568	20.1544	(88)
util rest of house	0.9926	0.9865	0.9737	0.9318	0.8346	0.6543	0.4742	0.5373	0.7978	0.9532	0.9866	0.9938	(89)
MIT 2	18.3109	18.5294	18.8761	19.3764	19.8044	20.0696	20.1438	20.1325	19.9508	19.4019	18.7798	18.2787	(90)
Living area fraction	18.4651	18.6836	19.0307	19.5321	19.9652	20.2385	20.3194	20.3056	20.1128	19.5563	18.9331	18.4321	(92)
MIT	18.4651	18.6836	19.0307	19.5321	19.9652	20.2385	20.3194	20.3056	20.1128	19.5563	18.9331	18.4321	(93)
Temperature adjustment													0.0000
adjusted MIT	18.4651	18.6836	19.0307	19.5321	19.9652	20.2385	20.3194	20.3056	20.1128	19.5563	18.9331	18.4321	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9893	0.9813	0.9659	0.9206	0.8264	0.6605	0.4924	0.5539	0.7946	0.9437	0.9816	0.9910	(94)	
Useful gains	782.4790	898.5698	977.3164	1063.7990	1034.5093	830.5660	589.8529	606.1656	785.3465	808.5782	766.8574	748.7772	(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	2385.0332	2316.9737	2102.9581	1770.7615	1374.5799	931.4687	614.4315	644.4017	995.8736	1489.5149	1973.6710	2381.0043	(97)	
Space heating kWh	1192.3003	953.1674	837.4774	509.0130	253.0125	0.0000	0.0000	0.0000	0.0000	506.6169	868.9058	1214.3770	(98a)	
Space heating requirement - total per year (kWh/year)												6334.8703		
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	1192.3003	953.1674	837.4774	509.0130	253.0125	0.0000	0.0000	0.0000	0.0000	506.6169	868.9058	1214.3770	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												6334.8703		
Space heating per m2												(98c) / (4) =	34.6622	(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	1552.8659	1222.4689	1253.9444	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7398	0.8168	0.7700	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1148.7427	998.5710	965.5944	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1370.2421	1304.5645	1187.6670	0.0000	0.0000	0.0000	0.0000	(103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	159.4795	227.6592	165.2220	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	39.8699	56.9148	41.3055	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling requirement													138.0902	(107)
Energy for space heating													34.6622	(99)
Energy for space cooling													0.7556	(108)
Total													35.4178	(109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	182.7600 (1b)	x 2.7900 (2b)	= 509.9004 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	182.7600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 509.9004 (5)
Dwelling volume			

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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0784 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3284 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3284 (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	0.4188	0.4106	0.4023	0.3613	0.3531	0.3120	0.3120	0.3038	0.3284	0.3531	0.3695	0.3859 (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	0.5877	0.5843	0.5809	0.5653	0.5623	0.5487	0.5487	0.5462	0.5539	0.5623	0.5683	0.5745 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			23.0800	1.1450	26.4275		(27)
EXTERNAL	111.0400	23.0800	87.9600	0.1800	15.8328		(29a)
HALLWAY	35.9400	2.9100	33.0300	0.1800	5.9454		(29a)
Flat Roof	124.1700		124.1700	0.1100	13.6587		(30)
Total net area of external elements Aum(A, m ²)			271.1500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	64.7744	(33)
Party Wall 1			32.1700	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 136.9634 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.3000	0.0500	0.6650
E3 Sill	6.7500	0.0500	0.3375
E4 Jamb	33.0000	0.0500	1.6500
E7 Party floor between dwellings (in blocks of flats)	52.6800	0.0700	3.6876
E14 Flat roof	40.9200	0.0800	3.2736
E16 Corner (normal)	16.7400	0.0900	1.5066
E17 Corner (inverted - internal area greater than external area)	16.7400	-0.0900	-1.5066
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	11.5300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.8300	0.1200	0.3396
E18 Party wall between dwellings	8.3700	0.0600	0.5022
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.4555 (36)

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Point Thermal bridges													(36a) =	0.0000
Total fabric heat loss													(33) + (36) + (36a) =	75.2299 (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	98.8879	98.3150	97.7534	95.1156	94.6221	92.3247	92.3247	91.8993	93.2097	94.6221	95.6205	96.6643	(38)	
Average = Sum(39)m / 12 =	174.1178	173.5448	172.9833	170.3455	169.8520	167.5546	167.5546	167.1292	168.4395	169.8520	170.8504	171.8941	(39)	170.3432
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	0.9527	0.9496	0.9465	0.9321	0.9294	0.9168	0.9168	0.9145	0.9216	0.9294	0.9348	0.9405	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		31

4. Water heating energy requirements (kWh/year)

Assumed occupancy														2.9794 (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	32.0210	31.5454	30.8757	29.6410	28.7164	27.6912	27.1374	27.8024	28.5264	29.6235	30.8837	31.9127		(42b)
Hot water usage for other uses	45.1424	43.5008	41.8593	40.2178	38.5762	36.9347	36.9347	38.5762	40.2178	41.8593	43.5008	45.1424	(42c)	45.1424 (42c)
Average daily hot water use (litres/day)														70.7270 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	77.1634	75.0463	72.7350	69.8587	67.2926	64.6258	64.0721	66.3786	68.7442	71.4828	74.3845	77.0551	(44)	
Energy content (annual)	122.2079	106.8649	111.7910	95.6331	90.5888	79.4650	77.4896	82.1906	84.7685	97.0014	105.9744	120.6497	(45)	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	103.8767	90.8351	95.0224	81.2881	77.0004	67.5452	65.8662	69.8620	72.0532	82.4512	90.0782	102.5522	(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	103.8767	90.8351	95.0224	81.2881	77.0004	67.5452	65.8662	69.8620	72.0532	82.4512	90.0782	102.5522	(64)	
12Total per year (kWh/year)														998 (64)
Electric shower(s)	59.4019	52.9276	57.7949	55.1530	56.1879	53.5978	55.3844	56.1879	55.1530	57.7949	56.7082	59.4019	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														675.6937 (64a)
Heat gains from water heating, kWh/month	40.8197	35.9407	38.2043	34.1103	33.2971	30.2858	30.3126	31.5125	31.8016	35.0615	36.6966	40.4885	(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	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	148.9717	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	196.1495	217.1656	196.1495	202.6879	196.1495	202.6879	196.1495	196.1495	202.6879	196.1495	202.6879	196.1495	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3504	358.0274	348.7614	329.0351	304.1342	280.7308	265.0959	261.4189	270.6849	290.4112	315.3122	338.7155	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	37.8972	(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)	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	-119.1774	(71)	
Water heating gains (Table 5)	54.8651	53.4832	51.3499	47.3754	44.7542	42.0636	40.7428	42.3555	44.1688	47.1257	50.9675	54.4201	(72)	
Total internal gains	673.0566	696.3677	663.9523	646.7898	612.7294	593.1737	569.6798	567.6154	585.2331	601.3780	636.6590	656.9766	(73)	

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	13.6200	10.6334	0.6300	0.7000	0.7700	44.2610 (74)
South	2.0300	46.7521	0.6300	0.7000	0.7700	29.0047 (78)
West	7.4300	19.6403	0.6300	0.7000	0.7700	44.5972 (80)

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Solar gains	117.8629	219.3289	347.9145	508.7977	639.0659	664.3990	628.1205	526.6667	403.1194	255.4425	144.5896	98.6355 (83)
Total gains	790.9195	915.6965	1011.8669	1155.5875	1251.7953	1257.5727	1197.8003	1094.2822	988.3525	856.8206	781.2486	755.6121 (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	39.9337	40.0656	40.1957	40.8181	40.9367	41.4980	41.4980	41.6036	41.2799	40.9367	40.6975	40.4503
alpha	3.6622	3.6710	3.6797	3.7212	3.7291	3.7665	3.7665	3.7736	3.7520	3.7291	3.7132	3.6967
util living area	0.9938	0.9887	0.9786	0.9454	0.8693	0.7232	0.5733	0.6349	0.8483	0.9642	0.9891	0.9948 (86)
MIT	18.9485	19.1721	19.5294	20.0576	20.5215	20.8408	20.9506	20.9275	20.6840	20.0844	19.4426	18.9270 (87)
Th 2	20.1229	20.1256	20.1282	20.1403	20.1426	20.1532	20.1532	20.1552	20.1491	20.1426	20.1380	20.1332 (88)
util rest of house	0.9926	0.9865	0.9741	0.9333	0.8385	0.6587	0.4784	0.5412	0.8014	0.9540	0.9866	0.9938 (89)
MIT 2	18.2182	18.4426	18.7993	19.3267	19.7684	20.0534	20.1314	20.1207	19.9278	19.3603	18.7219	18.2040 (90)
Living area fraction									f _{LA} = Living area / (4) =			
MIT	18.3764	18.6007	18.9575	19.4851	19.9316	20.2240	20.3089	20.2955	20.0916	19.5172	18.8780	18.3607 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3764	18.6007	18.9575	19.4851	19.9316	20.2240	20.3089	20.2955	20.0916	19.5172	18.8780	18.3607 (93)

8. Space heating requirement

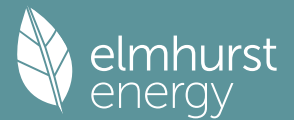
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9892	0.9813	0.9662	0.9219	0.8298	0.6646	0.4968	0.5579	0.7977	0.9443	0.9816	0.9908 (94)
Useful gains	782.3641	898.5443	977.6306	1065.2807	1038.7353	835.7310	595.0363	610.4850	788.4404	809.1270	766.8378	748.6845 (95)
Ext temp.	4.3000	4.9000	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	2450.9510	2377.6814	2154.9403	1803.1232	1398.1495	942.3336	621.4470	651.0499	1009.2242	1514.6008	2012.2830	2434.1377 (97)
Space heating kWh	1241.4287	993.9801	875.9184	531.2466	267.4042	0.0000	0.0000	0.0000	0.0000	524.8725	896.7205	1253.9772 (98a)
Space heating requirement - total per year (kWh/year)												6585.5482
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	1241.4287	993.9801	875.9184	531.2466	267.4042	0.0000	0.0000	0.0000	0.0000	524.8725	896.7205	1253.9772 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6585.5482
Space heating per m ²												(98c) / (4) = 36.0339 (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	1575.0135	1239.9042	1270.1818	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7320	0.8098	0.7632	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1152.9285	1004.0775	969.3768	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1370.2421	1304.5645	1187.6670	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	156.4658	223.5623	162.4079	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									f _C = 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	39.1164	55.8906	40.6020	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												135.6090 (107)
Energy for space heating												36.0339 (99)
Energy for space cooling												0.7420 (108)
Total												36.7759 (109)
Fabric Energy Efficiency (TFEE)												36.8 (109)

Predicted Energy Assessment

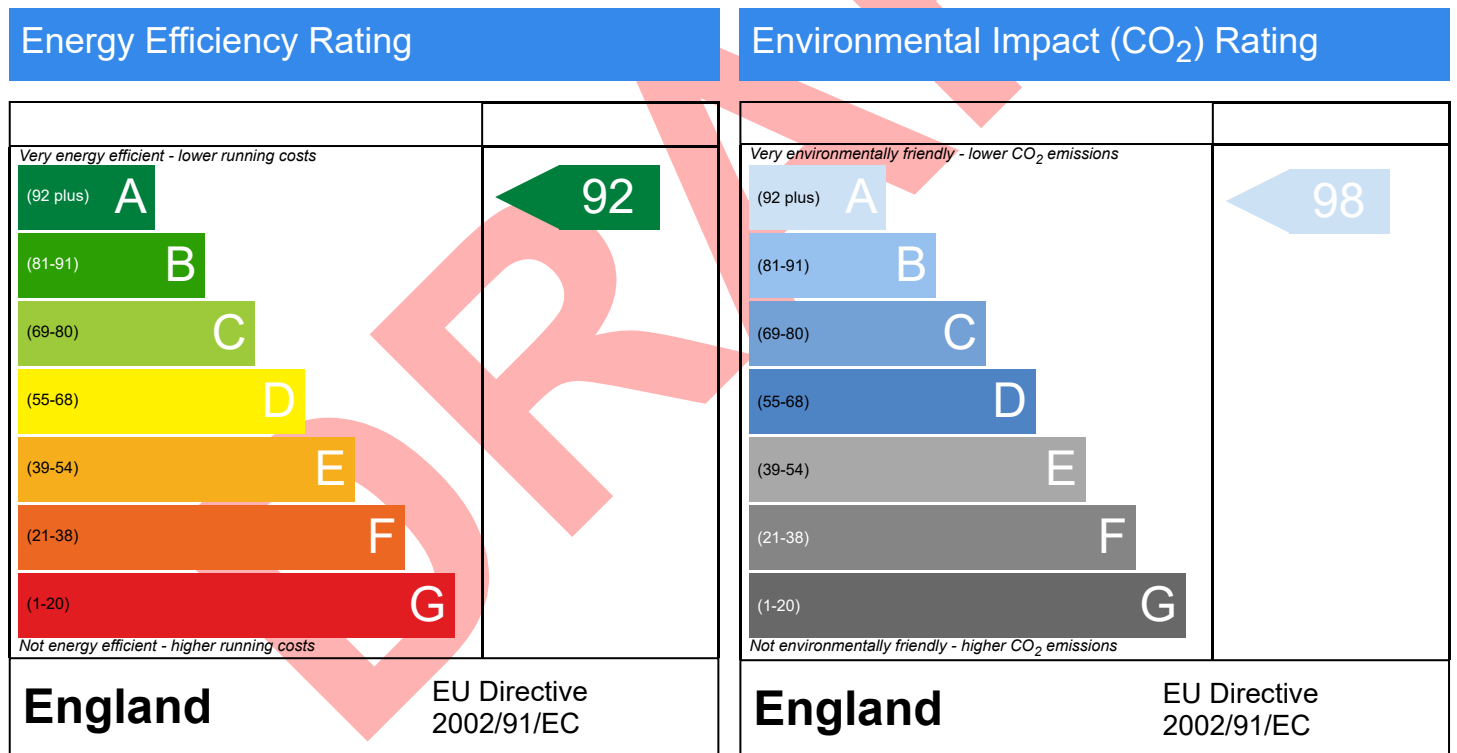


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Semi-Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 182.76 m²
 DRRN:

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.

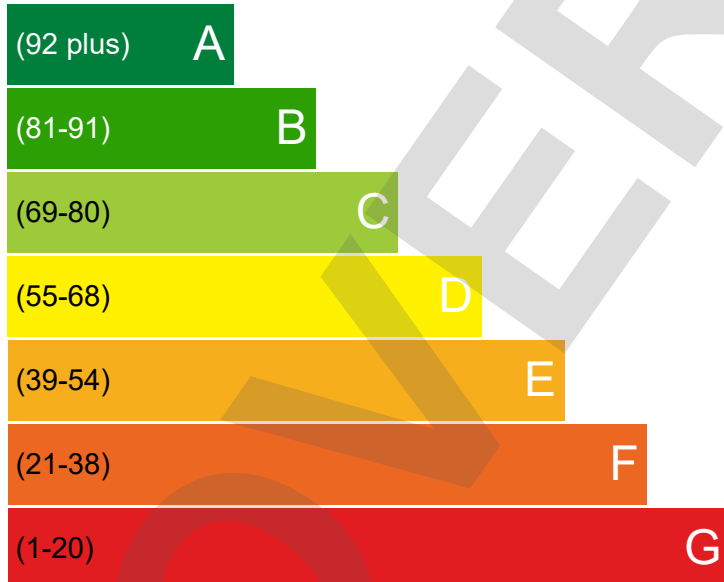
Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Semi-Detached
Floor Area [m ²]	183

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



CURRENT



POTENTIAL



Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excelent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 16 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.3** per year

With the recommended measures the potential CO emissions could be: **0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£399

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:04

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	249 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 6 - Boiler
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	9.14 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	12.32 kgCO ₂ /m ²	FAIL
1b Target primary energy rate and dwelling primary energy		
Target primary energy	47.95 kWh _{PE} /m ²	
Dwelling primary energy	68.21 kWh _{PE} /m ²	FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	39.2 kWh/m ²	
Dwelling fabric energy efficiency	38.3 kWh/m ²	OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	WEST # (1.2)	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)	73.87	0.18	
Sheltered wall: Walls (2)	33.83	0.18	
Exposed roof: Roof (1)	227.99	0.11	
Exposed roof: Roof (2)	20.79	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
WEST #, Windows	3.15	West	0.7	1.2
ENTRANCE DOOR #, Entrance Door	2.91	West	N/A	1.2
SOUTH #, Windows	16.21	South	0.7	1.2
NORTH #, Windows	32.3	North	0.7	1.2
EAST #, Windows	6.22	East	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.06	
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	

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	3 m ³ /hm ² , Design value (!)	OK
Air permeability test certificate reference		

4 Space heating

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

Efficiency	84.2%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Regular boiler
Manufacturer	Vaillant
Model	ecoFIT pure 630
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	500 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

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

Efficiency	
Manufacturer	
Model	

6 Controls

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

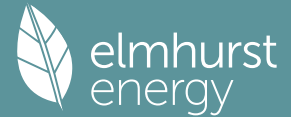
Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 6 - Boiler	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	86 B	DER	12.32	TER	9.14
Environmental	86 B	% DER < TER			-34.79
CO ₂ Emissions (t/year)	2.89	DFEE	38.31	TFEE	39.24
Compliance Check	See BREL	% DFEE < TFEE			2.37
% DPER < TPER	-42.25	DPER	68.21	TPER	47.95

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

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

Orientation

Property Tenure

Transaction Type

Terrain Type

1.0 Property Type

Position of Flat

Which Floor

2.0 Number of Storeys

3.0 Date Built

4.0 Sheltered Sides

5.0 Sunlight/Shade

6.0 Thermal Mass Parameter

Thermal Mass kJ/m²K

7.0 Electricity Tariff

Smart electricity meter fitted

Smart gas meter fitted

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	248.78 m ²	2.80 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area m²

9.0 External Walls

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
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	131.75	73.87	0.00	None	57.88	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	36.74	33.83	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	32.17	0.00	None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	227.99	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



External Roof 2 External Slope Roof Plasterboard, insulated slope 0.11 9.00 20.79 0.00 None 0.00 Enter Gross Area 0.00

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	248.78

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
WEST #	Windows	EXTERNAL	West	3.15	0
ENTRANCE DOOR #	Entrance Door	HALLWAY	West	2.91	0
SOUTH #	Windows	EXTERNAL	South	16.21	0
NORTH #	Windows	EXTERNAL	North	32.30	0
EAST #	Windows	EXTERNAL	East	6.22	0

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

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	25.02	0.30	0.30	No
E3 Sill	Independently assessed	7.16	0.04	0.04	No
E4 Jamb	Independently assessed	83.18	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	49.78	0.07	0.07	No
E14 Flat roof	Independently assessed	85.18	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.80	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	11.20	-0.09	-0.09	No
E11 Eaves (insulation at rafter level)	Independently assessed	37.72	0.04	0.04	No
R1 Head of roof window	Independently assessed	6.78	0.08	0.08	No
R2 Sill of roof window	Independently assessed	7.41	0.06	0.06	No
R3 Jamb of roof window	Independently assessed	12.88	0.08	0.08	No

Y-value 0.05 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 3.00 m³/(h.m²) @ 50 Pa

Property Tested? Yes

Test Method Blower Door

As Built AP₅₀ 0.10 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present Yes

Approved Installation No

Mechanical Ventilation data Type Database

Type Mechanical extract ventilation - centralised

MV Reference Number 500808

Configuration 4

Manufacturer SFP 0.18

Duct Type Rigid

MVHR Efficiency 0.00

Wet Rooms 4

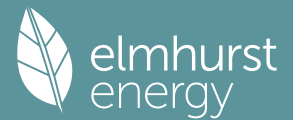
SFP from Installer Commissioning Certificate No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

No

Summary for Input Data



22.0 Lighting

No Fixed Lighting	No					
	Name Lighting 1	Efficacy 100.00	Power 10	Capacity 1000	Count 37	

24.0 Main Heating 1

Database	Database				
Percentage of Heat	100.00	%			
Database Ref. No.	17972				
Fuel Type	Mains gas				
SAP Code	0				
In Winter	89.20				
In Summer	80.20				
Model Name	ecoFIT pure 630				
Manufacturer	Vaillant				
System Type	Regular boiler				
Controls SAP Code	2110				
Delayed Start Stat	No				
Burner Control	Modulating				
HETAS approved System	No				
Oil Pump Inside	No				
FI Case	0.00				
Flue Type	Balanced				
Fan Assisted Flue	Yes				
Is MHS Pumped	Pump in heated space				
Heating Pump Age	2013 or later				
Heat Emitter	Radiators and Underfloor				
Underfloor Heating	Yes - Pipes in thin screed				
Flow Temperature	Unknown				
Boiler Interlock	No				
Combi boiler type	No Combi				
Combi keep hot type	None				

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	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

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	No
Summer Immersion	No
Cold Water Source	From mains

Summary for Input Data



Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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
Independent Time Control	Yes
Insulation Type	Foam
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

Thermal Store	None
---------------	------

Recommendations

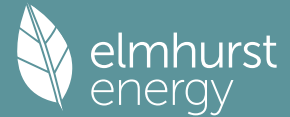
Lower cost measures

None

Further measures to achieve even higher standards

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

Full SAP Calculation Printout



Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 6 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	86 B	DER	12.32	TER	9.14
Environmental	86 B	% DER < TER			-34.79
CO ₂ Emissions (t/year)	2.89	DFEE	38.31	TFEE	39.24
Compliance Check	See BREL	% DFEE < TFEE			2.37
% DPER < TPER	-42.25	DPER	68.21	TPER	47.95
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	248.7800 (1b)	2.8000 (2b)	696.5840 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	248.7800		696.5840 (5)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 696.5840 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	0 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			57.8800	1.1450	66.2748		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	131.7500	57.8800	73.8700	0.1800	13.2966	70.0000	5170.9000 (29a)
HALLWAY	36.7400	2.9100	33.8300	0.1700	5.7511	70.0000	2368.1000 (29a)

Full SAP Calculation Printout



Flat Roof	227.9900	227.9900	0.1100	25.0789	9.0000	2051.9100 (30)
External Roof 2	20.7900	20.7900	0.1100	2.2869	9.0000	187.1100 (30)
Total net area of external elements Aum(A, m2)		417.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	116.1803		(33)
Party Floor 1		248.7800			40.0000	9951.2000 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19729.2200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.3039 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	25.0200	0.3000	7.5060
E3 Sill	7.1600	0.0400	0.2864
E4 Jamb	83.1800	0.0500	4.1590
E7 Party floor between dwellings (in blocks of flats)	49.7800	0.0700	3.4846
E14 Flat roof	85.1800	0.0400	3.4072
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	11.2000	-0.0900	-1.0080
E11 Eaves (insulation at rafter level)	37.7200	0.0400	1.5088
R1 Head of roof window	6.7800	0.0800	0.5424
R2 Sill of roof window	7.4100	0.0600	0.4446
R3 Jamb of roof window	12.8800	0.0800	1.0304

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.8734 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 139.0537 (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	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364 (38)
Average = Sum(39)m / 12 =	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209 (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													3.0653 (42)
Hot water usage for mixer showers	75.6156	74.4793	72.8234	69.6551	67.3170	64.7096	63.2276	64.8709	66.6723	69.4719	72.7082	75.3259	42a)
Hot water usage for baths	34.3583	33.8481	33.1295	31.8046	30.8125	29.7125	29.1183	29.8318	30.6087	31.7858	33.1380	34.2422	42b)
Hot water usage for other uses	48.4444	46.6828	44.9212	43.1596	41.3979	39.6363	39.6363	41.3979	43.1596	44.9212	46.6828	48.4444	42c)
Average daily hot water use (litres/day)													145.6110 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	158.4184	155.0101	150.8740	144.6193	139.5275	134.0584	131.9822	136.1007	140.4406	146.1789	152.5290	158.0125 (44)
Energy content (annual)	250.8960	220.7323	231.8878	197.9766	187.8308	164.8404	159.6210	168.5211	173.1773	198.3634	217.3056	247.4094 (45)
Distribution loss (46)m = 0.15 x (45)m	37.6344	33.1099	34.7832	29.6965	28.1746	24.7261	23.9431	25.2782	25.9766	29.7545	32.5958	37.1114 (46)

Water storage loss:
 Store volume 500.0000 (47)

b) If manufacturer declared loss factor is not known :
 Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0115 (51)
 Volume factor from Table 2a 0.6214 (52)
 Temperature factor from Table 2b 0.5400 (53)
 Enter (49) or (54) in (55) 1.9376 (55)

Total storage loss	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650 (56)
If cylinder contains dedicated solar storage	60.0650	54.2523	60.0650	58.1274	60.0650	58.1274	60.0650	60.0650	58.1274	60.0650	58.1274	60.0650 (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	334.2234	295.9958	315.2152	278.6160	271.1582	245.4799	242.9484	251.8485	253.8168	281.6908	297.9450	330.7368 (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 334.2234 295.9958 315.2152 278.6160 271.1582 245.4799 242.9484 251.8485 253.8168 281.6908 297.9450 330.7368 (64)
 Total per year (kWh/year) = Sum(64)m = 3399.6748 (64)
 3400 (64)

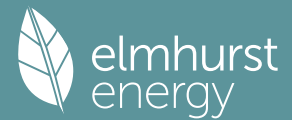
12Total per year (kWh/year)
 Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month
 150.0848 133.6043 143.7646 130.3388 129.1157 119.3210 119.7359 122.6952 122.0930 132.6178 136.7657 148.9256 (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
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(66)m	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	209.4843	231.9290	209.4843	216.4671	209.4843	216.4671	209.4843	209.4843	216.4671	209.4843	216.4671	209.4843	216.4671	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	415.3261	419.6358	408.7753	385.6546	356.4688	329.0382	310.7129	306.4032	317.2637	340.3844	369.5702	397.0008	397.0008	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	(71)
Water heating gains (Table 5)	201.7269	198.8159	193.2320	181.0261	173.5426	165.7236	160.9354	164.9129	169.5736	178.2497	189.9523	200.1688	200.1688	(72)
Total internal gains	898.5175	922.3610	883.4718	855.1279	811.4758	780.2091	750.1128	749.7805	772.2846	800.0986	847.9698	878.6340	878.6340	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
North	32.3000	10.6334	0.6300	0.7000	0.7700	104.9654 (74)						
East	6.2200	19.6403	0.6300	0.7000	0.7700	37.3344 (76)						
South	16.2100	46.7521	0.6300	0.7000	0.7700	231.6091 (78)						
West	3.1500	19.6403	0.6300	0.7000	0.7700	18.9073 (80)						
Solar gains	392.8162	689.9311	1005.2285	1357.8589	1630.4626	1668.7318	1587.8648	1375.5977	1125.2923	778.4581	474.1509	333.8864 (83)
Total gains	1291.3337	1612.2920	1888.7004	2212.9868	2441.9385	2448.9409	2337.9776	2125.3782	1897.5769	1578.5567	1322.1207	1212.5204 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770
tau	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385
util living area	0.9611	0.9347	0.8937	0.8143	0.6973	0.5550	0.4332	0.4837	0.6805	0.8618	0.9410	0.9663 (86)
MIT	18.6543	18.9639	19.3985	19.9340	20.3868	20.6777	20.7972	20.7710	20.5334	19.9267	19.1828	18.5842 (87)
Th 2	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659 (88)
util rest of house	0.9562	0.9268	0.8806	0.7909	0.6584	0.4952	0.3541	0.4031	0.6260	0.8390	0.9324	0.9620 (89)
MIT 2	17.2753	17.6664	18.2126	18.8742	19.4142	19.7384	19.8553	19.8346	19.5942	18.8798	17.9487	17.1863 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	17.5320	17.9079	18.4334	19.0715	19.5952	19.9132	20.0306	20.0089	19.7690	19.0747	18.1784	17.4465 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.5320	17.9079	18.4334	19.0715	19.5952	19.9132	20.0306	20.0089	19.7690	19.0747	18.1784	17.4465 (93)

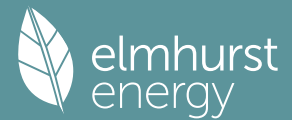
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9379	0.9027	0.8520	0.7618	0.6366	0.4847	0.3509	0.3979	0.6065	0.8091	0.9092	0.9453 (94)
Useful gains	1211.1637	1455.4581	1609.1009	1685.7873	1554.5566	1186.8815	820.3765	845.6290	1150.8065	1277.2248	1202.0600	1146.1463 (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	3360.8011	3303.8895	3030.9627	2583.4529	2005.3092	1349.5105	871.3387	916.6272	1439.8787	2152.4838	2813.8051	3364.4840 (97)
Space heating kWh	1599.3302	1242.1459	1057.8651	646.3193	335.3599	0.0000	0.0000	0.0000	0.0000	651.1927	1160.4565	1650.4433 (98a)
Space heating requirement - total per year (kWh/year)	8343.1129											
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	1599.3302	1242.1459	1057.8651	646.3193	335.3599	0.0000	0.0000	0.0000	0.0000	651.1927	1160.4565	1650.4433 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8343.1129											
Space heating per m2	(98c) / (4) = 33.5361 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from main system(s)	0.0000 (201)											
Efficiency of main space heating system 1 (in %)	1.0000 (202)											
Efficiency of main space heating system 2 (in %)	84.2000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	1599.3302	1242.1459	1057.8651	646.3193	335.3599	0.0000	0.0000	0.0000	0.0000	651.1927	1160.4565	1650.4433 (98)
Space heating efficiency (main heating system 1)	0.0000											

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Space heating fuel (main heating system)	84.2000	84.2000	84.2000	84.2000	84.2000	0.0000	0.0000	0.0000	0.0000	84.2000	84.2000	84.2000	(210)
Space heating efficiency (main heating system 2)	1899.4420	1475.2327	1256.3719	767.6001	398.2897	0.0000	0.0000	0.0000	0.0000	773.3880	1378.2143	1960.1464	(211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating requirement	334.2234	295.9958	315.2152	278.6160	271.1582	245.4799	242.9484	251.8485	253.8168	281.6908	297.9450	330.7368	(64)
Efficiency of water heater (217)m	82.5027	82.3144	81.9597	81.2833	79.9386	75.2000	75.2000	75.2000	75.2000	81.2765	82.2008	82.5597	(216)
Fuel for water heating, kWh/month	405.1062	359.5917	384.5976	342.7714	339.2081	326.4360	323.0697	334.9049	337.5223	346.5834	362.4598	400.6033	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	25.4929	23.0258	25.4929	24.6705	25.4929	24.6705	25.4929	25.4929	24.6705	25.4929	24.6705	25.4929	(231)
Lighting	40.5018	32.4921	29.2555	21.4338	16.5561	13.5265	15.1030	19.6315	25.4994	33.4566	37.7891	41.6275	(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												9908.6852	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.2000	(216)
Water heating fuel used												4262.8546	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520) mechanical ventilation fans (SFP = 0.2520) central heating pump main heating flue fan												214.1578	(230a)
Total electricity for the above, kWh/year												41.0000	(230c)
Electricity for lighting (calculated in Appendix L)												45.0000	(230e)
												300.1578	(231)
												326.8731	(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												14798.5706	(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	9908.6852	0.2100	2080.8239 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	4262.8546	0.2100	895.1995 (264)
Space and water heating			2976.0233 (265)
Pumps, fans and electric keep-hot	300.1578	0.1387	41.6356 (267)
Energy for lighting	326.8731	0.1443	47.1779 (268)
Total CO2, kg/year			3064.8368 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.3200 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	9908.6852	1.1300	11196.8142 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4262.8546	1.1300	4817.0257 (278)
Space and water heating			16013.8399 (279)
Pumps, fans and electric keep-hot	300.1578	1.5128	454.0787 (281)
Energy for lighting	326.8731	1.5338	501.3688 (282)
Total Primary energy kWh/year			16969.2874 (286)
Dwelling Primary energy Rate (DPER)			68.2100 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	248.7800 (1b)	x 2.8000 (2b)	= 696.5840 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	248.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	696.5840 (5)

2. Ventilation rate

		Air changes per hour
		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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0574 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3074 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3074 (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	0.3920	0.3843	0.3766	0.3382	0.3305	0.2921	0.2921	0.2844	0.3074	0.3305	0.3459	0.3612 (22b)
Effective ac	0.5768	0.5738	0.5709	0.5572	0.5546	0.5426	0.5426	0.5404	0.5473	0.5546	0.5598	0.5652 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			57.8800	1.1450	66.2748		(27)
EXTERNAL	131.7500	57.8800	73.8700	0.1800	13.2966		(29a)
HALLWAY	36.7400	2.9100	33.8300	0.1800	6.0894		(29a)
Flat Roof	227.9900		227.9900	0.1100	25.0789		(30)
External Roof 2	20.7900		20.7900	0.1100	2.2869		(30)
Total net area of external elements Aum(A, m ²)			417.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	115.9366	(33)

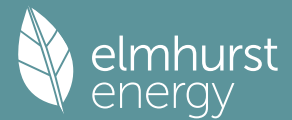
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

79.3039 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	25.0200	0.0500	1.2510
E3 Sill	7.1600	0.0500	0.3580
E4 Jamb	83.1800	0.0500	4.1590
E7 Party floor between dwellings (in blocks of flats)	49.7800	0.0700	3.4846
E14 Flat roof	85.1800	0.0800	6.8144
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	11.2000	-0.0900	-1.0080
E11 Eaves (insulation at rafter level)	37.7200	0.0400	1.5088
R1 Head of roof window	6.7800	0.0800	0.5424
R2 Sill of roof window	7.4100	0.0600	0.4446
R3 Jamb of roof window	12.8800	0.0800	1.0304
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			20.0972 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 136.0338 (37)

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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	132.5947	131.9090	131.2369	128.0800	127.4894	124.7398	124.7398	124.2306	125.7989	127.4894	128.6842	129.9334	(38)
Heat transfer coeff	268.6285	267.9428	267.2707	264.1138	263.5232	260.7736	260.7736	260.2644	261.8327	263.5232	264.7180	265.9672	(39)
Average = Sum(39)m / 12 =												264.1110	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0798	1.0770	1.0743	1.0616	1.0593	1.0482	1.0482	1.0462	1.0525	1.0593	1.0641	1.0691	(40)
HLP (average)												1.0616	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0653 (42)
Hot water usage for mixer showers	75.6156	74.4793	72.8234	69.6551	67.3170	64.7096	63.2276	64.8709	66.6723	69.4719	72.7082	75.3259	(42a)
Hot water usage for baths	32.6404	32.1557	31.4730	30.2144	29.2719	28.2268	27.6624	28.3402	29.0783	30.1965	31.4811	32.5301	(42b)
Hot water usage for other uses	46.0222	44.3487	42.6751	41.0016	39.3281	37.6545	37.6545	39.3281	41.0016	42.6751	44.3487	46.0222	(42c)
Average daily hot water use (litres/day)													141.8162 (43)
Daily hot water use	154.2782	150.9836	146.9715	140.8711	135.9170	130.5910	128.5444	132.5392	136.7522	142.3436	148.5380	153.8782	(44)
Energy content (annual)	244.3390	214.9986	225.8897	192.8454	182.9704	160.5768	155.4633	164.1112	168.6292	193.1589	211.6196	240.9360	(45)
Distribution loss (46)m = 0.15 x (45)m	36.6508	32.2498	33.8835	28.9268	27.4456	24.0865	23.3195	24.6167	25.2944	28.9738	31.7429	36.1404	(46)
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.9009 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.5665 (55)
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607	(56)
If cylinder contains dedicated solar storage													
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	(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	316.1621	279.8711	297.7128	262.3517	254.7935	230.0831	227.2865	235.9343	238.1354	264.9820	281.1258	312.7591	(62)
WWHRS	-34.5683	-30.5725	-32.0138	-26.5087	-24.7051	-21.1403	-19.8157	-21.0720	-21.8726	-25.7854	-29.2117	-33.9282	(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	281.5938	249.2986	265.6991	235.8430	230.0884	208.9427	207.4708	214.8623	216.2628	239.1966	251.9141	278.8310	(64)
12Total per year (kWh/year)													2880.0031 (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	138.7012	123.3850	132.5668	119.7261	118.2961	108.9968	109.1501	112.0255	111.6742	121.6838	125.9685	137.5697	(65)

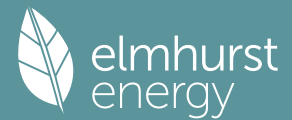
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	209.4843	231.9290	209.4843	216.4671	209.4843	216.4671	209.4843	209.4843	216.4671	209.4843	216.4671	209.4843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	415.3261	419.6358	408.7753	385.6546	356.4688	329.0382	310.7129	306.4032	317.2637	340.3844	369.5702	397.0008	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	(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)	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	(71)
Water heating gains (Table 5)	186.4264	183.6087	178.1812	166.2862	159.0002	151.3844	146.7071	150.5719	155.1030	163.5535	174.9563	184.9055	(72)
Total internal gains	883.2169	907.1537	868.4210	840.3881	796.9334	765.8699	735.8845	735.4395	757.8140	785.4024	832.9738	863.3708	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North		32.3000	10.6334	0.6300	0.7000	104.9654 (74)
East		6.2200	19.6403	0.6300	0.7000	37.3344 (76)

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South				16.2100	46.7521	0.6300	0.7000	0.7700	231.6091 (78)			
West			3.1500	19.6403	0.6300	0.7000	0.7700	18.9073 (80)				

Solar gains	392.8162	689.9311	1005.2285	1357.8589	1630.4626	1668.7318	1587.8648	1375.5977	1125.2923	778.4581	474.1509	333.8864 (83)
Total gains	1276.0331	1597.0848	1873.6496	2198.2470	2427.3961	2434.6017	2323.7493	2111.0372	1883.1063	1563.8605	1307.1247	1197.2572 (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, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.4012	20.4534	20.5048	20.7499	20.7964	21.0157	21.0157	21.0568	20.9307	20.7964	20.7026	20.6053
alpha	2.3601	2.3636	2.3670	2.3833	2.3864	2.4010	2.4010	2.4038	2.3954	2.3864	2.3802	2.3737
util living area	0.9626	0.9376	0.8988	0.8218	0.7081	0.5651	0.4433	0.4937	0.6907	0.8676	0.9434	0.9675 (86)
MIT	17.8628	18.2848	18.8849	19.6522	20.2891	20.7140	20.8855	20.8486	20.5073	19.6562	18.6289	17.7986 (87)
Th 2	20.0174	20.0196	20.0219	20.0323	20.0342	20.0434	20.0434	20.0450	20.0398	20.0342	20.0303	20.0262 (88)
util rest of house	0.9578	0.9298	0.8858	0.7985	0.6687	0.5038	0.3612	0.4107	0.6355	0.8450	0.9350	0.9633 (89)
MIT 2	16.3103	16.8450	17.6015	18.5572	19.3201	19.8020	19.9701	19.9426	19.5919	18.5830	17.2933	16.2334 (90)
Living area fraction	16.5993	17.1130	17.8404	18.7610	19.5005	19.9717	20.1405	20.1113	19.7623	18.7828	17.5419	16.5247 (92)
MIT	16.5993	17.1130	17.8404	18.7610	19.5005	19.9717	20.1405	20.1113	19.7623	18.7828	17.5419	16.5247 (93)
Temperature adjustment												0.0000
adjusted MIT	16.5993	17.1130	17.8404	18.7610	19.5005	19.9717	20.1405	20.1113	19.7623	18.7828	17.5419	16.5247 (93)

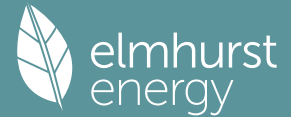
8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9322	0.8968	0.8475	0.7615	0.6442	0.4989	0.3700	0.4168	0.6175	0.8075	0.9037	0.9399 (94)
Useful gains	1189.5565	1432.2792	1587.9295	1673.9649	1563.7680	1214.6276	859.8648	879.9083	1162.7518	1262.8141	1181.2086	1125.2670 (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	3303.9438	3272.3837	3030.9513	2604.4265	2055.6178	1400.8063	923.2769	965.9126	1482.5707	2156.3494	2764.1559	3277.9731 (97)
Space heating kWh	1573.1041	1236.5502	1073.6082	669.9323	365.9362	0.0000	0.0000	0.0000	0.0000	664.7903	1139.7221	1601.6133 (98a)
Space heating requirement - total per year (kWh/year)												8325.2568
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	1573.1041	1236.5502	1073.6082	669.9323	365.9362	0.0000	0.0000	0.0000	0.0000	664.7903	1139.7221	1601.6133 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8325.2568
Space heating per m2											(98c) / (4) =	33.4643 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
												0.0000 (201)
Fraction of space heat from main system(s)												
												1.0000 (202)
Efficiency of main space heating system 1 (in %)												
												92.3000 (206)
Efficiency of main space heating system 2 (in %)												
												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												
												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1573.1041	1236.5502	1073.6082	669.9323	365.9362	0.0000	0.0000	0.0000	0.0000	664.7903	1139.7221	1601.6133 (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)	1704.3382	1339.7077	1163.1725	725.8205	396.4639	0.0000	0.0000	0.0000	0.0000	720.2495	1234.8018	1735.2257 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	281.5938	249.2986	265.6991	235.8430	230.0884	208.9427	207.4708	214.8623	216.2628	239.1966	251.9141	278.8310 (64)
Efficiency of water heater (217)m	87.3050	87.1509	86.8566	86.2667	85.0951	79.8000	79.8000	79.8000	79.8000	86.2268	87.0233	79.8000 (216)
Fuel for water heating, kWh/month	322.5401	286.0541	305.9053	273.3882	270.3896	261.8330	259.9884	269.2510	271.0060	277.4040	289.4788	319.2499 (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	43.5267	34.9187	31.4404	23.0346	17.7926	14.5367	16.2310	21.0977	27.4038	35.9553	40.6114	44.7364 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-60.0025	-85.5511	-124.2933	-141.1967	-153.3179	-143.2873	-141.3176	-132.7803	-118.0645	-98.2759	-66.2289	-51.7478 (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)

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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	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-31.0632	-65.6478	-131.1037	-197.8923	-262.7259	-264.5460	-261.6368	-221.2200	-161.6006	-94.4463	-41.6394	-24.5580		(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													9019.7799	(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													3406.4885	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													86.0000	(231)
Electricity for lighting (calculated in Appendix L)													351.2854	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3074.1437	(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													9789.4100	(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	9019.7799	0.2100	1894.1538 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3406.4885	0.2100	715.3626 (264)
Space and water heating			2609.5163 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	351.2854	0.1443	50.7013 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1316.0638	0.1344	-176.8715
PV Unit electricity exported	-1758.0799	0.1257	-221.0443
Total			-397.9158 (269)
Total CO2, kg/year			2274.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.1400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	9019.7799	1.1300	10192.3512 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3406.4885	1.1300	3849.3320 (278)
Space and water heating			14041.6832 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	351.2854	1.5338	538.8133 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1316.0638	1.4967	-1969.7373
PV Unit electricity exported	-1758.0799	0.4615	-811.3681
Total			-2781.1054 (283)
Total Primary energy kWh/year			11929.4919 (286)
Target Primary Energy Rate (TPER)			47.9500 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 6 - Boiler	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	86 B	DER	12.32	TER	9.14
Environmental	86 B	% DER < TER			-34.79
CO ₂ Emissions (t/year)	2.89	DFEE	38.31	TFEE	39.24
Compliance Check	See BREL	% DFEE < TFEE			2.37
% DPER < TPER	-42.25	DPER	68.21	TPER	47.95
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	248.7800 (1b)	x 2.8000 (2b)	= 696.5840 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	248.7800		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 696.5840 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0574 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2074 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2074 (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	0.2645	0.2593	0.2541	0.2282	0.2230	0.1971	0.1971	0.1919	0.2074	0.2230	0.2334	0.2437 (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	0.5350	0.5336	0.5323	0.5260	0.5249	0.5194	0.5194	0.5184	0.5215	0.5249	0.5272	0.5297 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			57.8800	1.1450	66.2748		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	131.7500	57.8800	73.8700	0.1800	13.2966	70.0000	5170.9000 (29a)
HALLWAY	36.7400	2.9100	33.8300	0.1700	5.7511	70.0000	2368.1000 (29a)
Flat Roof	227.9900		227.9900	0.1100	25.0789	9.0000	2051.9100 (30)
External Roof 2	20.7900		20.7900	0.1100	2.2869	9.0000	187.1100 (30)

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Total net area of external elements $A_{um}(A, m^2)$ 417.2700 (31)
 Fabric heat loss, $W/K = \text{Sum}(A \times U)$ (26)...(30) + (32) = 116.1803 (33)
 Party Floor 1 248.7800 40.0000 9951.2000 (32d)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 19729.2200 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m^2K 79.3039 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	25.0200	0.3000	7.5060
E2 Other lintels (including other steel lintels)	7.1600	0.0400	0.2864
E3 Sill	83.1800	0.0500	4.1590
E4 Jamb	49.7800	0.0700	3.4846
E7 Party floor between dwellings (in blocks of flats)	85.1800	0.0400	3.4072
E14 Flat roof	16.8000	0.0900	1.5120
E16 Corner (normal)	11.2000	-0.0900	-1.0080
E17 Corner (inverted - internal area greater than external area)	37.7200	0.0400	1.5088
E11 Eaves (insulation at rafter level)	6.7800	0.0800	0.5424
R1 Head of roof window	7.4100	0.0600	0.4446
R2 Sill of roof window	12.8800	0.0800	1.0304
R3 Jamb of roof window			

Thermal bridges ($\text{Sum}(L \times \text{Psi})$) calculated using Appendix K) 22.8734 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 139.0537 (37)

Ventilation heat loss calculated monthly (38) $m = 0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38) m	122.9752	122.6630	122.3570	120.9199	120.6510	119.3993	119.3993	119.1675	119.8814	120.6510	121.1950	121.7636
Heat transfer coeff	262.0289	261.7167	261.4108	259.9736	259.7047	258.4530	258.4530	258.2212	258.9351	259.7047	260.2487	260.8173
Average = $\text{Sum}(39)m / 12 =$												259.9723

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0533	1.0520	1.0508	1.0450	1.0439	1.0389	1.0389	1.0379	1.0408	1.0439	1.0461	1.0484
HLP (average)												1.0450
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.0653
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
Hot water usage for baths	32.6404	32.1557	31.4730	30.2144	29.2719	28.2268	27.6624	28.3402	29.0783	30.1965	31.4811	32.5301
Hot water usage for other uses	46.0222	44.3487	42.6751	41.0016	39.3281	37.6545	37.6545	39.3281	41.0016	42.6751	44.3487	46.0222
Average daily hot water use (litres/day)												72.1012

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	78.6626	76.5043	74.1481	71.2159	68.5999	65.8814	65.3169	67.6683	70.0799	72.8716	75.8298	78.5523
Energy content (annual)	124.5823	108.9411	113.9629	97.4911	92.3487	81.0088	78.9951	83.7874	86.4155	98.8861	108.0334	122.9938
Distribution loss (46) $m = 0.15 \times (45)m$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total = $\text{Sum}(45)m =$												1197.4463

Water storage loss:
 Total storage loss 0.0000 (56)

If cylinder contains dedicated solar storage
 Primary loss 0.0000 (57)
 Combi loss 0.0000 (59)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total heat required for water heating calculated for each month	105.8950	92.5999	96.8685	82.8674	78.4964	68.8575	67.1458	71.2193	73.4532	84.0532	91.8284	104.5448
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
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
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
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

Output from w/h 105.8950 92.5999 96.8685 82.8674 78.4964 68.8575 67.1458 71.2193 73.4532 84.0532 91.8284 104.5448 (64)
 Total per year (kWh/year) = $\text{Sum}(64)m =$ 1017.8294 (64)
 1018 (64)

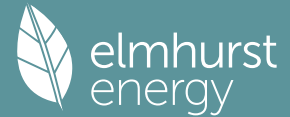
12Total per year (kWh/year)
 Electric shower(s) 60.5555 53.9555 58.9173 56.2241 57.2791 54.6387 56.4600 57.2791 56.2241 58.9173 57.8094 60.5555 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = $\text{Sum}(64a)m =$ 688.8154 (64a)

Heat gains from water heating, kWh/month 41.6126 36.6389 38.9464 34.7729 33.9439 30.8740 30.9014 32.1246 32.4193 35.7426 37.4095 41.2751 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts												
(66) m	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	209.4843	231.9290	209.4843	216.4671	209.4843	216.4671	209.4843	209.4843	216.4671	209.4843	216.4671	209.4843
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	415.3261	419.6358	408.7753	385.6546	356.4688	329.0382	310.7129	306.4032	317.2637	340.3844	369.5702	397.0008
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267
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

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Losses e.g. evaporation (negative values) (Table 5)	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	(71)
Water heating gains (Table 5)	55.9309	54.5221	52.3474	48.2956	45.6235	42.8806	41.5342	43.1782	45.0268	48.0412	51.9576	55.4772	(72)
Total internal gains	749.7215	775.0672	739.5872	719.3975	680.5567	657.3661	630.7116	628.0458	647.7378	666.8901	706.9751	730.9425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
North	32.3000	10.6334	0.6300	0.7000	0.7700	104.9654	(74)						
East	6.2200	19.6403	0.6300	0.7000	0.7700	37.3344	(76)						
South	16.2100	46.7521	0.6300	0.7000	0.7700	231.6091	(78)						
West	3.1500	19.6403	0.6300	0.7000	0.7700	18.9073	(80)						
Solar gains	392.8162	689.9311	1005.2285	1357.8589	1630.4626	1668.7318	1587.8648	1375.5977	1125.2923	778.4581	474.1509	333.8864	(83)
Total gains	1142.5377	1464.9982	1744.8157	2077.2564	2311.0194	2326.0979	2218.5764	2003.6435	1773.0301	1445.3482	1181.1260	1064.8289	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	20.9150	20.9400	20.9645	21.0804	21.1022	21.2044	21.2044	21.2234	21.1649	21.1022	21.0581	21.0122	
tau	2.3943	2.3960	2.3976	2.4054	2.4068	2.4136	2.4136	2.4149	2.4110	2.4068	2.4039	2.4008	
util living area	0.9700	0.9466	0.9095	0.8346	0.7219	0.5799	0.4571	0.5108	0.7095	0.8829	0.9533	0.9744	(86)
MIT	17.8189	18.2466	18.8526	19.6206	20.2700	20.7012	20.8795	20.8389	20.4827	19.6075	18.5673	17.7379	(87)
Th 2	20.0392	20.0402	20.0412	20.0460	20.0469	20.0511	20.0511	20.0518	20.0495	20.0469	20.0451	20.0432	(88)
util rest of house	0.9661	0.9399	0.8978	0.8125	0.6835	0.5188	0.3741	0.4269	0.6557	0.8623	0.9462	0.9711	(89)
MIT 2	17.0989	17.5218	18.1181	18.8642	19.4722	19.8531	19.9904	19.9661	19.6797	18.8673	17.8469	17.0210	(90)
Living area fraction	17.2329	17.6567	18.2549	19.0050	19.6207	20.0110	20.1559	20.1285	19.8291	19.0051	17.9810	17.1545	(91)
MIT	17.2329	17.6567	18.2549	19.0050	19.6207	20.0110	20.1559	20.1285	19.8291	19.0051	17.9810	17.1545	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2329	17.6567	18.2549	19.0050	19.6207	20.0110	20.1559	20.1285	19.8291	19.0051	17.9810	17.1545	(93)

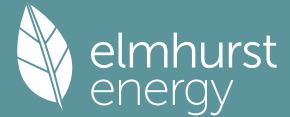
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9497	0.9170	0.8697	0.7839	0.6643	0.5160	0.3838	0.4342	0.6416	0.8340	0.9249	0.9563	(94)
Useful gains	1085.0310	1343.3384	1517.4453	1628.3309	1535.3063	1200.2553	851.5524	869.9865	1137.5736	1205.4101	1092.4683	1018.3170	(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	3388.7956	3338.6519	3072.8475	2627.0243	2057.0476	1398.4845	919.0444	962.7881	1483.4757	2182.8337	2831.7626	3378.7548	(97)
Space heating kWh	1714.0009	1340.8507	1157.2192	719.0592	388.1756	0.0000	0.0000	0.0000	0.0000	727.2032	1252.2919	1756.1658	(98a)
Space heating requirement - total per year (kWh/year)												9054.9664	
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	1714.0009	1340.8507	1157.2192	719.0592	388.1756	0.0000	0.0000	0.0000	0.0000	727.2032	1252.2919	1756.1658	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9054.9664	
Space heating per m2										(98c) / (4) =		36.3975	(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	2429.4581	1912.5521	1962.4810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7333	0.7944	0.7540	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1781.5594	1519.3769	1479.7991	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2620.5415	2498.8002	2251.8456	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	604.0671	728.6909	574.4026	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction													
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	151.0168	182.1727	143.6007	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												476.7902	(107)
Energy for space heating												36.3975	(99)
Energy for space cooling												1.9165	(108)

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Total Fabric Energy Efficiency (DFEE) 38.3140 (109)
38.3 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	248.7800 (1b)	x 2.8000 (2b)	= 696.5840 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	248.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 696.5840 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0574 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3074 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3074 (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	0.3920	0.3843	0.3766	0.3382	0.3305	0.2921	0.2921	0.2844	0.3074	0.3305	0.3459	0.3612 (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	0.5768	0.5738	0.5709	0.5572	0.5546	0.5426	0.5426	0.5404	0.5473	0.5546	0.5598	0.5652 (25)

3. Heat losses and heat loss parameter

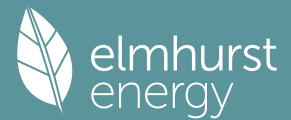
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			57.8800	1.1450	66.2748		(27)
EXTERNAL	131.7500	57.8800	73.8700	0.1800	13.2966		(29a)
HALLWAY	36.7400	2.9100	33.8300	0.1800	6.0894		(29a)
Flat Roof	227.9900		227.9900	0.1100	25.0789		(30)
External Roof 2	20.7900		20.7900	0.1100	2.2869		(30)
Total net area of external elements Aum(A, m ²)			417.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	115.9366	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 79.3039 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	25.0200	0.0500	1.2510
E3 Sill	7.1600	0.0500	0.3580
E4 Jamb	83.1800	0.0500	4.1590
E7 Party floor between dwellings (in blocks of flats)	49.7800	0.0700	3.4846
E14 Flat roof	85.1800	0.0800	6.8144
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	11.2000	-0.0900	-1.0080
E11 Eaves (insulation at rafter level)	37.7200	0.0400	1.5088
R1 Head of roof window	6.7800	0.0800	0.5424
R2 Sill of roof window	7.4100	0.0600	0.4446

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East			6.2200		19.6403		0.6300		0.7000		0.7700		37.3344 (76)
South			16.2100		46.7521		0.6300		0.7000		0.7700		231.6091 (78)
West			3.1500		19.6403		0.6300		0.7000		0.7700		18.9073 (80)

Solar gains	392.8162	689.9311	1005.2285	1357.8589	1630.4626	1668.7318	1587.8648	1375.5977	1125.2923	778.4581	474.1509	333.8864	(83)
Total gains	1142.5377	1464.9982	1744.8157	2077.2564	2311.0194	2326.0979	2218.5764	2003.6435	1773.0301	1445.3482	1181.1260	1064.8289	(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	20.4012	20.4534	20.5048	20.7499	20.7964	21.0157	21.0157	21.0568	20.9307	20.7964	20.7026	20.6053	
alpha	2.3601	2.3636	2.3670	2.3833	2.3864	2.4010	2.4010	2.4038	2.3954	2.3864	2.3802	2.3737	
util living area	0.9702	0.9472	0.9108	0.8366	0.7251	0.5825	0.4598	0.5132	0.7121	0.8841	0.9536	0.9745	(86)
MIT	17.7473	18.1788	18.7934	19.5855	20.2473	20.6937	20.8759	20.8350	20.4701	19.5794	18.5253	17.6819	(87)
Th 2	20.0174	20.0196	20.0219	20.0323	20.0342	20.0434	20.0434	20.0450	20.0398	20.0342	20.0303	20.0262	(88)
util rest of house	0.9662	0.9404	0.8990	0.8145	0.6866	0.5209	0.3759	0.4286	0.6580	0.8635	0.9465	0.9711	(89)
MIT 2	17.0145	17.4421	18.0478	18.8213	19.4422	19.8407	19.9810	19.9573	19.6614	18.8319	17.7963	16.9551	(90)
Living area fraction									fLA = Living area / (4) =				0.1861 (91)
MIT	17.1509	17.5792	18.1866	18.9635	19.5921	19.9995	20.1476	20.1207	19.8120	18.9711	17.9320	17.0904	(92)
Temperature adjustment													0.0000
adjusted MIT	17.1509	17.5792	18.1866	18.9635	19.5921	19.9995	20.1476	20.1207	19.8120	18.9711	17.9320	17.0904	(93)

8. Space heating requirement

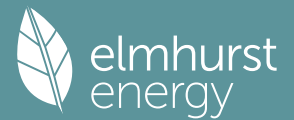
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9496	0.9172	0.8705	0.7854	0.6667	0.5179	0.3856	0.4358	0.6434	0.8348	0.9250	0.9562	(94)
Useful gains	1084.9043	1343.7114	1518.9354	1631.4343	1540.8284	1204.6650	855.5356	873.2178	1140.8456	1206.6391	1092.5880	1018.1785	(95)
Ext temp.	4.3000	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	3452.1285	3397.3111	3123.4732	2657.9200	2079.7499	1408.0432	925.1243	968.3629	1495.5803	2205.9715	2867.4300	3428.4155	(97)
Space heating kWh	1761.2148	1380.0190	1193.7761	739.0697	400.9576	0.0000	0.0000	0.0000	0.0000	743.5033	1277.8862	1793.2163	(98a)
Space heating requirement - total per year (kWh/year)												9289.6431	
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	1761.2148	1380.0190	1193.7761	739.0697	400.9576	0.0000	0.0000	0.0000	0.0000	743.5033	1277.8862	1793.2163	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9289.6431	
Space heating per m2													(98c) / (4) = 37.3408 (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	2451.2717	1929.7246	1978.0095	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7292	0.7906	0.7505	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1787.3574	1525.6535	1484.4127	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2620.5415	2498.8002	2251.8456	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	599.8925	724.0212	570.9701	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	149.9731	181.0053	142.7425	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													473.7209 (107)
Energy for space heating													37.3408 (99)
Energy for space cooling													1.9042 (108)
Total													39.2450 (109)
Fabric Energy Efficiency (TFEE)													39.2 (109)

Predicted Energy Assessment

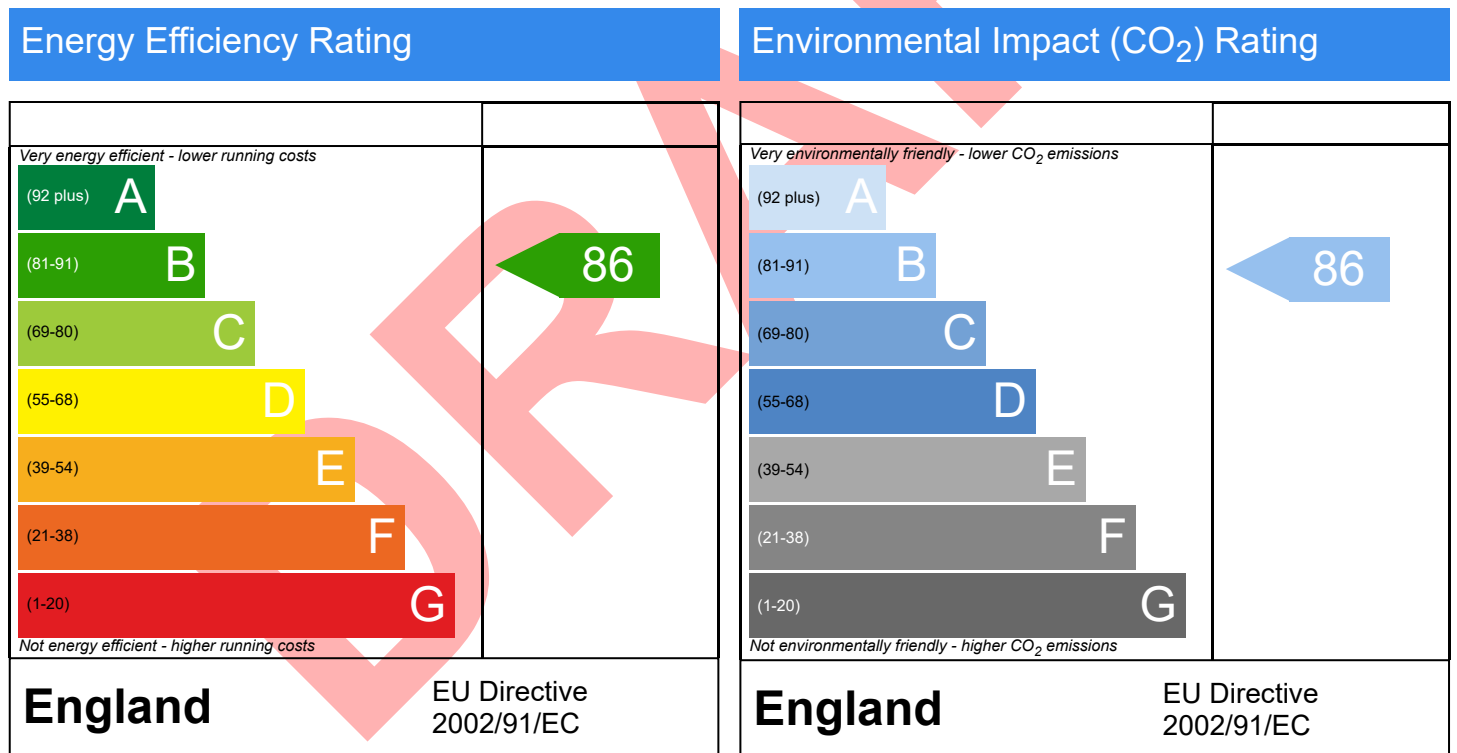


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 248.78 m²
 DRRN:

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.

Overview Report

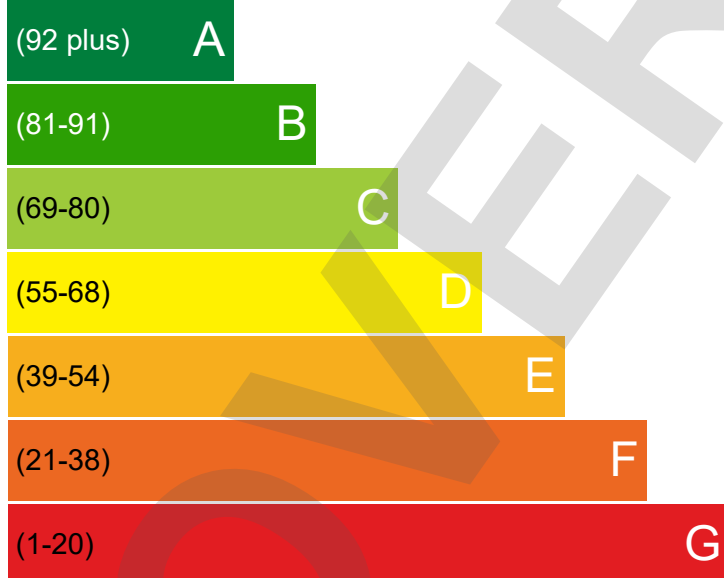
Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Detached
Floor Area [m ²]	249

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



CURRENT

POTENTIAL

86

86

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excelent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 65 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **2.9** per year

With the recommended measures the potential CO emissions could be: **3** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
---------------------	-----------------------	--	-------------------------------	-----------------------------

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£874

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2023
Date of certificate	10/07/2023
Type of assessment	SAP, new dwelling

OVERVIEW

Building Regulations England Part L (BREL) Compliance Report

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

Date: Mon 10 Jul 2023 20:16:06

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Detached
OCDEA Registration	EES/004083	Assessment Date	2023-07-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	249 m ²
Site Reference	20 Watford Way	Plot Reference	Flat 6 - Heatpump + PV
Address	20 Watford Way, RADLETT, WD7 8LE		

Client Details	
Name	Mark Simons
Company	EAL Consult
Address	17 Dobree Avenue, London, NW10 2AD

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	9.14 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	1.6 kgCO ₂ /m ²	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	47.95 kWh _{PE} /m ²	
Dwelling primary energy	16.25 kWh _{PE} /m ²	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	39.2 kWh/m ²	
Dwelling fabric energy efficiency	38.3 kWh/m ²	OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	N/A	N/A	N/A
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.2	WEST # (1.2)	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)	73.87	0.18	
Sheltered wall: Walls (2)	33.83	0.18	
Exposed roof: Roof (1)	227.99	0.11	
Exposed roof: Roof (2)	20.79	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
WEST #, Windows	3.15	West	0.7	1.2
ENTRANCE DOOR #, Entrance Door	2.91	West	N/A	1.2
SOUTH #, Windows	16.21	South	0.7	1.2
NORTH #, Windows	32.3	North	0.7	1.2
EAST #, Windows	6.22	East	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E17: Corner (inverted - internal area greater than external area)	Calculated by person with suitable expertise	-0.09	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
Roof	R1: Head of roof window	Calculated by person with suitable expertise	0.08	
Roof	R2: Sill of roof window	Calculated by person with suitable expertise	0.06	
Roof	R3: Jamb of roof window	Calculated by person with suitable expertise	0.08	

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	3 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	460.5%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	MIDEA
Model	MHC-V16W/D2N8-B
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	500 litres
Declared heat loss	2.1 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

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

Efficiency	
Manufacturer	
Model	

6 Controls

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

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

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

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	0.7 W/(l/s)	
Specific fan power	0.18 W/(l/s)	OK
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model	MVDC-MSH Uniflex, 498502	
Commissioning		

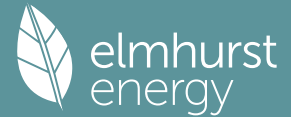
9 Local generation	
Technology type: Photovoltaic system (1)	
Peak power	1.79 kWp
Orientation	South
Pitch	30°
Overshading	None or very little
Manufacturer	PV
MCS certificate	

10 Heat networks	
N/A	

11 Supporting documentary evidence	
N/A	

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:
b. Client Declaration	
N/A	

Summary for Input Data



Property Reference	20 Watford Way	Issued on Date	10/07/2023
Assessment Reference	Flat 6 - Heatpump + PV	Prop Type Ref	20 Watford Way
Property	20, Watford Way, RADLETT, WD7 8LE		

SAP Rating	92 A	DER	1.60	TER	9.14
Environmental	98 A	% DER < TER			82.49
CO ₂ Emissions (t/year)	0.37	DFEE	38.31	TFEE	39.24
Compliance Check	See BREL	% DFEE < TFEE			2.37
% DPER < TPER	66.12	DPER	16.25	TPER	47.95

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

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

Orientation	South	
Property Tenure	1	
Transaction Type	6	
Terrain Type	Suburban	
1.0 Property Type	Flat, Detached	
Position of Flat	Top-floor flat	
Which Floor	2	
2.0 Number of Storeys	1	
3.0 Date Built	2023	
4.0 Sheltered Sides	0	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	N/A	kJ/m ² K
7.0 Electricity Tariff	Standard	
Smart electricity meter fitted	Yes	
Smart gas meter fitted	Yes	

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Basement:	0.00 m	0.00 m ²	0.00 m
Ground floor:	1.00 m	248.78 m ²	2.80 m
1st Storey:	0.00 m	0.00 m ²	0.00 m
2nd Storey:	0.00 m	0.00 m ²	0.00 m
3rd Storey:	0.00 m	0.00 m ²	0.00 m
4th Storey:	0.00 m	0.00 m ²	0.00 m
5th Storey:	0.00 m	0.00 m ²	0.00 m
6th Storey:	0.00 m	0.00 m ²	0.00 m
7th Storey:	0.00 m	0.00 m ²	0.00 m

8.0 Living Area	46.31	m ²
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9.0 External Walls											
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	
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	131.75	73.87	0.00	None	57.88	Enter Gross Area	
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.18	70.00	36.74	33.83	0.50	Stairwell Access Corridor 1	2.91	Enter Gross Area	

9.1 Party Walls									
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	Shelter Res	Shelter		
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	32.17	0.00	None		

10.0 External Roofs										
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	227.99	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data



External Roof 2 External Slope Roof Plasterboard, insulated slope 0.11 9.00 20.79 0.00 None 0.00 Enter Gross Area 0.00

11.1 Party Floors

Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	248.78

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Rooflights	Manufacturer	Roof Light	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.05		Air Filled	0.63	Wood	0.70	1.20
Entrance Door	Manufacturer	Solid Door			Air Filled	0.00	Wood	0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
WEST #	Windows	EXTERNAL	West	3.15	0
ENTRANCE DOOR #	Entrance Door	HALLWAY	West	2.91	0
SOUTH #	Windows	EXTERNAL	South	16.21	0
NORTH #	Windows	EXTERNAL	North	32.30	0
EAST #	Windows	EXTERNAL	East	6.22	0

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

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	25.02	0.30	0.30	No
E3 Sill	Independently assessed	7.16	0.04	0.04	No
E4 Jamb	Independently assessed	83.18	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	49.78	0.07	0.07	No
E14 Flat roof	Independently assessed	85.18	0.04	0.04	No
E16 Corner (normal)	Independently assessed	16.80	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	11.20	-0.09	-0.09	No
E11 Eaves (insulation at rafter level)	Independently assessed	37.72	0.04	0.04	No
R1 Head of roof window	Independently assessed	6.78	0.08	0.08	No
R2 Sill of roof window	Independently assessed	7.41	0.06	0.06	No
R3 Jamb of roof window	Independently assessed	12.88	0.08	0.08	No

Y-value 0.05 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 3.00 m³/(h.m²) @ 50 Pa

Property Tested? Yes

Test Method Blower Door

As Built AP₅₀ 0.10 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present Yes

Approved Installation No

Mechanical Ventilation data Type Database

Type Mechanical extract ventilation - centralised

MV Reference Number 500808

Configuration 4

Manufacturer SFP 0.18

Duct Type Rigid

MVHR Efficiency 0.00

Wet Rooms 4

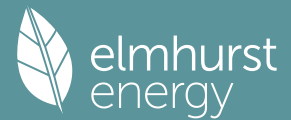
SFP from Installer Commissioning Certificate No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

No

Summary for Input Data



22.0 Lighting

No Fixed Lighting

No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	37

24.0 Main Heating 1

Percentage of Heat

100.00

%

Database Ref. No.

105566

Fuel Type

Electricity

SAP Code

0

In Winter

0.00

In Summer

0.00

Model Name

MHC-V16W/D2N8-B

Manufacturer

MIDEA

System Type

Heat Pump

Controls SAP Code

2207

Delayed Start Stat

No

Burner Control

Modulating

HETAS approved System

No

Oil Pump Inside

No

FI Case

0.00

Flue Type

None or Unknown

Fan Assisted Flue

No

Is MHS Pumped

Pump in heated space

Heating Pump Age

2013 or later

Heat Emitter

Radiators and Underfloor

Underfloor Heating

Yes - Pipes in thin screed

Flow Temperature

Enter value

Flow Temperature Value

35.00

Boiler Interlock

No

Combi boiler type

No Combi

Combi keep hot type

None

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	None								
Heat source 2	None								
Heat source 3	None								
Heat source 4	None								
Heat source 5	None								

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

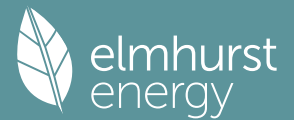
Water use <= 125 litres/person/day

No

Summer Immersion

No

Summary for Input Data



Cold Water Source	From mains
Bath Count	2
Supplementary Immersion	No
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
SHOWER	Vented hot water system	7.00		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
Independent Time Control	Yes
Insulation Type	Measured Loss
Insulation Thickness Type	80 mm
Insulation Thickness	80
Cylinder Volume	500.00 L
Loss	2.10 kWh/day
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

Thermal Store	None
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32.0 Photovoltaic Unit

Photovoltaic Unit	One Dwelling
Export Capable Meter?	No
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
1.79	South	30°	None Or Little	No	No	1.00		PV

34.0 Small-scale Hydro

Small-scale Hydro	None
Electricity Generated	0.00 kWh/Year
Apportioned	0.00 kWh/Year
Connected to dwelling's electricity meter	Yes
Electricity Generation	Annual

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

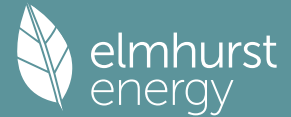
Lower cost measures

None

Further measures to achieve even higher standards

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

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 6 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	92 A	DER	1.60	TER	9.14
Environmental	98 A	% DER < TER			82.49
CO ₂ Emissions (t/year)	0.37	DFEE	38.31	TFEE	39.24
Compliance Check	See BREL	% DFEE < TFEE			2.37
% DPER < TPER	66.12	DPER	16.25	TPER	47.95
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	248.7800 (1b)	x 2.8000 (2b)	= 696.5840 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	248.7800		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 696.5840 (5)

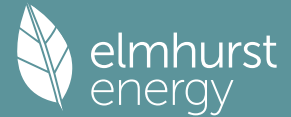
2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)	
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)	
Adj infilt rate	0.1912 0.1875 0.1837 0.1650 0.1612 0.1425 0.1425 0.1388 0.1500 0.1612 0.1687 0.1762 (22b)	
Mechanical extract ventilation - centralised		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
Effective ac	0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			57.8800	1.1450	66.2748		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	131.7500	57.8800	73.8700	0.1800	13.2966	70.0000	5170.9000 (29a)
HALLWAY	36.7400	2.9100	33.8300	0.1700	5.7511	70.0000	2368.1000 (29a)

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Flat Roof	227.9900	227.9900	0.1100	25.0789	9.0000	2051.9100 (30)
External Roof 2	20.7900	20.7900	0.1100	2.2869	9.0000	187.1100 (30)
Total net area of external elements Aum(A, m2)		417.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	116.1803		(33)
Party Floor 1		248.7800			40.0000	9951.2000 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19729.2200 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 79.3039 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	25.0200	0.3000	7.5060
E3 Sill	7.1600	0.0400	0.2864
E4 Jamb	83.1800	0.0500	4.1590
E7 Party floor between dwellings (in blocks of flats)	49.7800	0.0700	3.4846
E14 Flat roof	85.1800	0.0400	3.4072
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	11.2000	-0.0900	-1.0080
E11 Eaves (insulation at rafter level)	37.7200	0.0400	1.5088
R1 Head of roof window	6.7800	0.0800	0.5424
R2 Sill of roof window	7.4100	0.0600	0.4446
R3 Jamb of roof window	12.8800	0.0800	1.0304

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.8734 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 139.0537 (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	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364	114.9364
Average = Sum(39)m / 12 =	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901	253.9901 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209	1.0209 (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													3.0653 (42)
Hot water usage for mixer showers	75.6156	74.4793	72.8234	69.6551	67.3170	64.7096	63.2276	64.8709	66.6723	69.4719	72.7082	75.3259	42a)
Hot water usage for baths	34.3583	33.8481	33.1295	31.8046	30.8125	29.7125	29.1183	29.8318	30.6087	31.7858	33.1380	34.2422	42b)
Hot water usage for other uses	48.4444	46.6828	44.9212	43.1596	41.3979	39.6363	39.6363	41.3979	43.1596	44.9212	46.6828	48.4444	42c)
Average daily hot water use (litres/day)													145.6110 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	158.4184	155.0101	150.8740	144.6193	139.5275	134.0584	131.9822	136.1007	140.4406	146.1789	152.5290	158.0125	44)
Energy content (annual)	250.8960	220.7323	231.8878	197.9766	187.8308	164.8404	159.6210	168.5211	173.1773	198.3634	217.3056	247.4094	45)
Distribution loss (46)m = 0.15 x (45)m	37.6344	33.1099	34.7832	29.6965	28.1746	24.7261	23.9431	25.2782	25.9766	29.7545	32.5958	37.1114	46)

Water storage loss:
 Store volume 500.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 2.1000 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 1.1340 (55)

If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	56)
Primary loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	57)
Combi 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)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	61)

WWHRS	309.3124	273.4955	290.3042	254.5086	246.2472	221.3724	218.0374	226.9375	229.7093	256.7798	273.8376	305.8258	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)

Total per year (kWh/year) = Sum(64)m = 3106.3676 (64)
 3106 (64)

12Total per year (kWh/year)
 Electric shower(s) 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

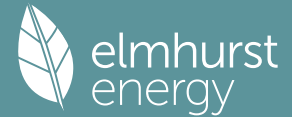
Heat gains from water heating, kWh/month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	130.1560	115.6041	123.8358	111.0528	109.1869	100.0350	99.8071	102.7664	102.8071	112.6890	117.4797	128.9967	65)

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	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.4843	231.9290	209.4843	216.4671	209.4843	216.4671	209.4843	209.4843	216.4671	209.4843	216.4671	209.4843	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	415.3261	419.6358	408.7753	385.6546	356.4688	329.0382	310.7129	306.4032	317.2637	340.3844	369.5702	397.0008	(68)
Pumps, fans	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	(71)
Total internal gains	174.9409	172.0299	166.4460	154.2400	146.7565	138.9376	134.1493	138.1268	142.7876	151.4636	163.1662	173.3827	(72)
	868.7314	892.5749	853.6858	825.3418	781.6898	753.4231	723.3267	722.9945	745.4985	770.3125	818.1838	848.8479	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	32.3000	10.6334	0.6300	0.7000	0.7700	104.9654	(74)
East	6.2200	19.6403	0.6300	0.7000	0.7700	37.3344	(76)
South	16.2100	46.7521	0.6300	0.7000	0.7700	231.6091	(78)
West	3.1500	19.6403	0.6300	0.7000	0.7700	18.9073	(80)

Solar gains	392.8162	689.9311	1005.2285	1357.8589	1630.4626	1668.7318	1587.8648	1375.5977	1125.2923	778.4581	474.1509	333.8864	(83)
Total gains	1261.5477	1582.5060	1858.9143	2183.2008	2412.1524	2422.1548	2311.1916	2098.5921	1870.7908	1548.7707	1292.3347	1182.7343	(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	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	21.5770	
alpha	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	2.4385	
util living area	0.9629	0.9370	0.8967	0.8181	0.7017	0.5593	0.4373	0.4885	0.6857	0.8661	0.9435	0.9680	(86)
Living	18.6349	18.9460	19.3829	19.9221	20.3793	20.6742	20.7956	20.7687	20.5271	19.9127	19.1645	18.5644	
Non living	17.2507	17.6440	18.1935	18.8602	19.4060	19.7353	19.8541	19.8329	19.5879	18.8631	17.9259	17.1612	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7901	18.9460	19.3829	19.9221	20.3793	20.6742	20.7956	20.7687	20.5271	19.9127	19.1645	18.9051	(87)
Th 2	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	20.0659	(88)
util rest of house	0.9582	0.9294	0.8838	0.7950	0.6630	0.4993	0.3576	0.4074	0.6314	0.8438	0.9353	0.9639	(89)
MIT 2	18.9436	17.6440	18.1935	18.8602	19.4060	19.7353	19.8541	19.8329	19.5879	18.8631	17.9259	17.6847	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	19.1012	17.8864	18.4149	19.0579	19.5872	19.9100	20.0294	20.0071	19.7627	19.0585	18.1564	17.9118	(92)
Temperature adjustment	0.0000												
adjusted MIT	19.1012	17.8864	18.4149	19.0579	19.5872	19.9100	20.0294	20.0071	19.7627	19.0585	18.1564	17.9118	(93)

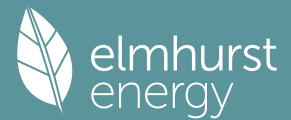
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9525	0.9057	0.8554	0.7657	0.6409	0.4885	0.3543	0.4020	0.6115	0.8140	0.9126	0.9514	(94)
Useful gains	1201.6658	1433.2306	1590.0919	1671.6890	1545.8745	1183.2428	818.9548	843.5639	1143.9543	1260.6317	1179.3755	1125.2282	(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	3759.3491	3298.4188	3026.2569	2580.0070	2003.2732	1348.6996	871.0263	916.1696	1438.2765	2148.3772	2808.2279	3482.6712	(97)
Space heating kWh	1902.9164	1253.4065	1068.5068	653.9889	340.3047	0.0000	0.0000	0.0000	0.0000	660.4827	1172.7738	1753.9375	(98a)
Space heating requirement - total per year (kWh/year)	8806.3173												
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	1902.9164	1253.4065	1068.5068	653.9889	340.3047	0.0000	0.0000	0.0000	0.0000	660.4827	1172.7738	1753.9375	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	8806.3173												
Space heating per m2	(98c) / (4) = 35.3980 (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 %)	460.4995 (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

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Space heating requirement	1902.9164	1253.4065	1068.5068	653.9889	340.3047	0.0000	0.0000	0.0000	0.0000	660.4827	1172.7738	1753.9375	(98)
Space heating efficiency (main heating system 1)	460.4995	460.4995	460.4995	460.4995	460.4995	0.0000	0.0000	0.0000	0.0000	460.4995	460.4995	460.4995	(210)
Space heating fuel (main heating system)	413.2288	272.1841	232.0321	142.0173	73.8990	0.0000	0.0000	0.0000	0.0000	143.4275	254.6743	380.8772	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	309.3124	273.4955	290.3042	254.5086	246.2472	221.3724	218.0374	226.9375	229.7093	256.7798	273.8376	305.8258	(64)
Efficiency of water heater (217)m	298.0804	298.0804	298.0804	298.0804	298.0804	298.0804	298.0804	298.0804	298.0804	298.0804	298.0804	298.0804	(216)
Fuel for water heating, kWh/month	103.7681	91.7523	97.3912	85.3825	82.6110	74.2660	73.1472	76.1330	77.0629	86.1445	91.8670	102.5984	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.1887	16.4285	18.1887	17.6020	18.1887	17.6020	18.1887	18.1887	17.6020	18.1887	17.6020	18.1887	(231)
Lighting	40.5018	32.4921	29.2555	21.4338	16.5561	13.5265	15.1030	19.6315	25.4994	33.4566	37.7891	41.6275	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-36.5398	-55.6095	-86.3000	-103.5846	-115.8831	-106.0310	-104.5843	-95.7347	-80.9842	-65.5604	-41.2362	-30.9726	(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												1912.3403	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												298.0804	
Water heating fuel used												1042.1241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.2520)													
mechanical ventilation fans (SFP = 0.2520)												214.1578	(230a)
Total electricity for the above, kWh/year												214.1578	(231)
Electricity for lighting (calculated in Appendix L)												326.8731	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-923.0204	(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												2572.4749	(238)

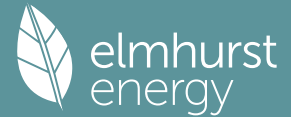
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1912.3403	0.1551	296.5147 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1042.1241	0.1409	146.8807 (264)
Space and water heating			443.3955 (265)
Pumps, fans and electric keep-hot	214.1578	0.1387	29.7063 (267)
Energy for lighting	326.8731	0.1443	47.1779 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-923.0204	0.1336	-123.2929
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-123.2929 (269)
Total CO2, kg/year			396.9867 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.6000 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1912.3403	1.5740	3010.0070 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1042.1241	1.5212	1585.2380 (278)

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Space and water heating			4595.2449 (279)
Pumps, fans and electric keep-hot	214.1578	1.5128	323.9779 (281)
Energy for lighting	326.8731	1.5338	501.3688 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-923.0204	1.4936	-1378.6463 (283)
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1378.6463 (283)
Total Primary energy kWh/year			4041.9453 (286)
Dwelling Primary energy Rate (DPER)			16.2500 (287)

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

1. Overall dwelling characteristics

		Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor		248.7800 (1b)	x 2.8000 (2b)	= 696.5840 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	248.7800				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	696.5840 (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		4 * 10 =	40.0000 (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) =		40.0000 / (5) =	0.0574 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3074 (18)
Number of sides sheltered			0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3074 (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												
Effective ac	0.3920	0.3843	0.3766	0.3382	0.3305	0.2921	0.2921	0.2844	0.3074	0.3305	0.3459	0.3612 (22b)
	0.5768	0.5738	0.5709	0.5572	0.5546	0.5426	0.5426	0.5404	0.5473	0.5546	0.5598	0.5652 (25)

3. Heat losses and heat loss parameter

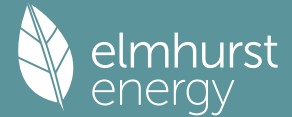
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			57.8800	1.1450	66.2748		(27)
EXTERNAL	131.7500	57.8800	73.8700	0.1800	13.2966		(29a)
HALLWAY	36.7400	2.9100	33.8300	0.1800	6.0894		(29a)
Flat Roof	227.9900		227.9900	0.1100	25.0789		(30)
External Roof 2	20.7900		20.7900	0.1100	2.2869		(30)
Total net area of external elements Aum(A, m ²)			417.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	115.9366	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 79.3039 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	25.0200	0.0500	1.2510
E3 Sill	7.1600	0.0500	0.3580
E4 Jamb	83.1800	0.0500	4.1590
E7 Party floor between dwellings (in blocks of flats)	49.7800	0.0700	3.4846

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E14 Flat roof	85.1800	0.0800	6.8144
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	11.2000	-0.0900	-1.0080
E11 Eaves (insulation at rafter level)	37.7200	0.0400	1.5088
R1 Head of roof window	6.7800	0.0800	0.5424
R2 Sill of roof window	7.4100	0.0600	0.4446
R3 Jamb of roof window	12.8800	0.0800	1.0304
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			20.0972 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	136.0338 (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	132.5947	131.9090	131.2369	128.0800	127.4894	124.7398	124.7398	124.2306	125.7989	127.4894	128.6842	129.9334 (38)
Average = Sum(39)m / 12 =	268.6285	267.9428	267.2707	264.1138	263.5232	260.7736	260.7736	260.2644	261.8327	263.5232	264.7180	265.9672 (39)
												264.1110

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0798	1.0770	1.0743	1.0616	1.0593	1.0482	1.0482	1.0462	1.0525	1.0593	1.0641	1.0691 (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													3.0653 (42)
Hot water usage for mixer showers	75.6156	74.4793	72.8234	69.6551	67.3170	64.7096	63.2276	64.8709	66.6723	69.4719	72.7082	75.3259 (42a)	
Hot water usage for baths	32.6404	32.1557	31.4730	30.2144	29.2719	28.2268	27.6624	28.3402	29.0783	30.1965	31.4811	32.5301 (42b)	
Hot water usage for other uses	46.0222	44.3487	42.6751	41.0016	39.3281	37.6545	37.6545	39.3281	41.0016	42.6751	44.3487	46.0222 (42c)	
Average daily hot water use (litres/day)													141.8162 (43)
Daily hot water use	154.2782	150.9836	146.9715	140.8711	135.9170	130.5910	128.5444	132.5392	136.7522	142.3436	148.5380	153.8782 (44)	
Energy conte	244.3390	214.9986	225.8897	192.8454	182.9704	160.5768	155.4633	164.1112	168.6292	193.1589	211.6196	240.9360 (45)	
Energy content (annual)													Total = Sum(45)m = 2355.5381
Distribution loss (46)m = 0.15 x (45)m	36.6508	32.2498	33.8835	28.9268	27.4456	24.0865	23.3195	24.6167	25.2944	28.9738	31.7429	36.1404 (46)	
Water storage loss:													500.0000 (47)
Store volume													2.9009 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.5665 (55)
Enter (49) or (54) in (55)													
Total storage loss	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (56)	
If cylinder contains dedicated solar storage	48.5607	43.8613	48.5607	46.9942	48.5607	46.9942	48.5607	48.5607	46.9942	48.5607	46.9942	48.5607 (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	316.1621	279.8711	297.7128	262.3517	254.7935	230.0831	227.2865	235.9343	238.1354	264.9820	281.1258	312.7591 (62)	
WWHRS	-34.5683	-30.5725	-32.0138	-26.5087	-24.7051	-21.1403	-19.8157	-21.0720	-21.8726	-25.7854	-29.2117	-33.9282 (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	281.5938	249.2986	265.6991	235.8430	230.0884	208.9427	207.4708	214.8623	216.2628	239.1966	251.9141	278.8310 (64)	
Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2880.0031 (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	138.7012	123.3850	132.5668	119.7261	118.2961	108.9968	109.1501	112.0255	111.6742	121.6838	125.9685	137.5697 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	209.4843	231.9290	209.4843	216.4671	209.4843	216.4671	209.4843	209.4843	216.4671	209.4843	216.4671	209.4843 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	415.3261	419.6358	408.7753	385.6546	356.4688	329.0382	310.7129	306.4032	317.2637	340.3844	369.5702	397.0008 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267 (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)	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138 (71)	
Water heating gains (Table 5)	186.4264	183.6087	178.1812	166.2862	159.0002	151.3844	146.7071	150.5719	155.1030	163.5535	174.9563	184.9055 (72)	
Total internal gains	883.2169	907.1537	868.4210	840.3881	796.9334	765.8699	735.8845	735.4395	757.8140	785.4024	832.9738	863.3708 (73)	

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North		32.3000	10.6334	0.6300	0.7000	0.7700	104.9654 (74)					
East		6.2200	19.6403	0.6300	0.7000	0.7700	37.3344 (76)					
South		16.2100	46.7521	0.6300	0.7000	0.7700	231.6091 (78)					
West		3.1500	19.6403	0.6300	0.7000	0.7700	18.9073 (80)					
Solar gains	392.8162	689.9311	1005.2285	1357.8589	1630.4626	1668.7318	1587.8648	1375.5977	1125.2923	778.4581	474.1509	333.8864 (83)
Total gains	1276.0331	1597.0848	1873.6496	2198.2470	2427.3961	2434.6017	2323.7493	2111.0372	1883.1063	1563.8605	1307.1247	1197.2572 (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	20.4012	20.4534	20.5048	20.7499	20.7964	21.0157	21.0157	21.0568	20.9307	20.7964	20.7026	20.6053
alpha	2.3601	2.3636	2.3670	2.3833	2.3864	2.4010	2.4010	2.4038	2.3954	2.3864	2.3802	2.3737
util living area	0.9626	0.9376	0.8988	0.8218	0.7081	0.5651	0.4433	0.4937	0.6907	0.8676	0.9434	0.9675 (86)
MIT	17.8628	18.2848	18.8849	19.6522	20.2891	20.7140	20.8855	20.8486	20.5073	19.6562	18.6289	17.7986 (87)
Th 2	20.0174	20.0196	20.0219	20.0323	20.0342	20.0434	20.0434	20.0450	20.0398	20.0342	20.0303	20.0262 (88)
util rest of house	0.9578	0.9298	0.8858	0.7985	0.6687	0.5038	0.3612	0.4107	0.6355	0.8450	0.9350	0.9633 (89)
MIT 2	16.3103	16.8450	17.6015	18.5572	19.3201	19.8020	19.9701	19.9426	19.5919	18.5830	17.2933	16.2334 (90)
Living area fraction									fLA = Living area / (4) =			0.1861 (91)
MIT	16.5993	17.1130	17.8404	18.7610	19.5005	19.9717	20.1405	20.1113	19.7623	18.7828	17.5419	16.5247 (92)
Temperature adjustment												0.0000
adjusted MIT	16.5993	17.1130	17.8404	18.7610	19.5005	19.9717	20.1405	20.1113	19.7623	18.7828	17.5419	16.5247 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9322	0.8968	0.8475	0.7615	0.6442	0.4989	0.3700	0.4168	0.6175	0.8075	0.9037	0.9399 (94)
Useful gains	1189.5565	1432.2792	1587.9295	1673.9649	1563.7680	1214.6276	859.8648	879.9083	1162.7518	1262.8141	1181.2086	1125.2670 (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	3303.9438	3272.3837	3030.9513	2604.4265	2055.6178	1400.8063	923.2769	965.9126	1482.5707	2156.3494	2764.1559	3277.9731 (97)
Space heating kWh	1573.1041	1236.5502	1073.6082	669.9323	365.9362	0.0000	0.0000	0.0000	0.0000	664.7903	1139.7221	1601.6133 (98a)
Space heating requirement - total per year (kWh/year)												8325.2568
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	1573.1041	1236.5502	1073.6082	669.9323	365.9362	0.0000	0.0000	0.0000	0.0000	664.7903	1139.7221	1601.6133 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8325.2568
Space heating per m2												(98c) / (4) = 33.4643 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

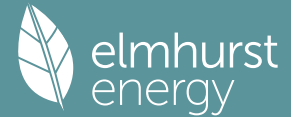
Efficiency of main space heating system 1 (in %) 92.3000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1573.1041	1236.5502	1073.6082	669.9323	365.9362	0.0000	0.0000	0.0000	0.0000	664.7903	1139.7221	1601.6133 (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)	1704.3382	1339.7077	1163.1725	725.8205	396.4639	0.0000	0.0000	0.0000	0.0000	720.2495	1234.8018	1735.2257 (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	281.5938	249.2986	265.6991	235.8430	230.0884	208.9427	207.4708	214.8623	216.2628	239.1966	251.9141	278.8310 (64)
Efficiency of water heater												79.8000 (216)
(217)m	87.3050	87.1509	86.8566	86.2667	85.0951	79.8000	79.8000	79.8000	79.8000	86.2268	87.0233	87.3394 (217)
Fuel for water heating, kWh/month												

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Space cooling fuel requirement (221)m	322.5401	286.0541	305.9053	273.3882	270.3896	261.8330	259.9884	269.2510	271.0060	277.4040	289.4788	319.2499	(219)
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	(221)
Lighting	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)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	43.5267	34.9187	31.4404	23.0346	17.7926	14.5367	16.2310	21.0977	27.4038	35.9553	40.6114	44.7364	(232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-60.0025	-85.5511	-124.2933	-141.1967	-153.3179	-143.2873	-141.3176	-132.7803	-118.0645	-98.2759	-66.2289	-51.7478	(233a)
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	(234a)
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	(235a)
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	(235c)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	-31.0632	-65.6478	-131.1037	-197.8923	-262.7259	-264.5460	-261.6368	-221.2200	-161.6006	-94.4463	-41.6394	-24.5580	(233b)
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	(234b)
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	(235b)
Annual totals kWh/year													
Space heating fuel - main system 1													9019.7799 (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													3406.4885 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													351.2854 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-3074.1437 (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													9789.4100 (238)

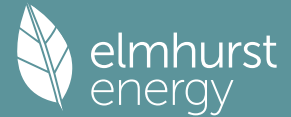
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	9019.7799	0.2100	1894.1538 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3406.4885	0.2100	715.3626 (264)
Space and water heating			2609.5163 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	351.2854	0.1443	50.7013 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1316.0638	0.1344	-176.8715
PV Unit electricity exported	-1758.0799	0.1257	-221.0443
Total			-397.9158 (269)
Total CO2, kg/year			2274.2311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.1400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	9019.7799	1.1300	10192.3512 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3406.4885	1.1300	3849.3320 (278)
Space and water heating			14041.6832 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	351.2854	1.5338	538.8133 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1316.0638	1.4967	-1969.7373
PV Unit electricity exported	-1758.0799	0.4615	-811.3681
Total			-2781.1054 (283)
Total Primary energy kWh/year			11929.4919 (286)
Target Primary Energy Rate (TPER)			47.9500 (287)

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Property Reference	20 Watford Way		Issued on Date	10/07/2023	
Assessment Reference	Flat 6 - Heatpump + PV	Prop Type Ref	20 Watford Way		
Property	20, Watford Way, RADLETT, WD7 8LE				
SAP Rating	92 A	DER	1.60	TER	9.14
Environmental	98 A	% DER < TER			82.49
CO ₂ Emissions (t/year)	0.37	DFEE	38.31	TFEE	39.24
Compliance Check	See BREL	% DFEE < TFEE			2.37
% DPER < TPER	66.12	DPER	16.25	TPER	47.95
Assessor Details	Mr. Mark Simons			Assessor ID	5542-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	248.7800 (1b)	x 2.8000 (2b)	= 696.5840 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	248.7800		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 696.5840 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0574 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2074 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2074 (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	0.2645	0.2593	0.2541	0.2282	0.2230	0.1971	0.1971	0.1919	0.2074	0.2230	0.2334	0.2437 (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	0.5350	0.5336	0.5323	0.5260	0.5249	0.5194	0.5194	0.5184	0.5215	0.5249	0.5272	0.5297 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (U _w = 1.20)			57.8800	1.1450	66.2748		(27)
Entrance Door			2.9100	1.2000	3.4920		(26)
EXTERNAL	131.7500	57.8800	73.8700	0.1800	13.2966	70.0000	5170.9000 (29a)
HALLWAY	36.7400	2.9100	33.8300	0.1700	5.7511	70.0000	2368.1000 (29a)
Flat Roof	227.9900		227.9900	0.1100	25.0789	9.0000	2051.9100 (30)
External Roof 2	20.7900		20.7900	0.1100	2.2869	9.0000	187.1100 (30)

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Total net area of external elements $A_{um}(A, m^2)$ 417.2700 (31)
 Fabric heat loss, $W/K = \text{Sum}(A \times U)$ (26)...(30) + (32) = 116.1803 (33)
 Party Floor 1 248.7800 40.0000 9951.2000 (32d)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 19729.2200 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 79.3039 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	25.0200	0.3000	7.5060
E3 Sill	7.1600	0.0400	0.2864
E4 Jamb	83.1800	0.0500	4.1590
E7 Party floor between dwellings (in blocks of flats)	49.7800	0.0700	3.4846
E14 Flat roof	85.1800	0.0400	3.4072
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	11.2000	-0.0900	-1.0080
E11 Eaves (insulation at rafter level)	37.7200	0.0400	1.5088
R1 Head of roof window	6.7800	0.0800	0.5424
R2 Sill of roof window	7.4100	0.0600	0.4446
R3 Jamb of roof window	12.8800	0.0800	1.0304

Thermal bridges ($\text{Sum}(L \times \text{Psi})$) calculated using Appendix K) 22.8734 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 139.0537 (37)

Ventilation heat loss calculated monthly (38) $m = 0.33 \times (25)m \times (5)$

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	122.9752	122.6630	122.3570	120.9199	120.6510	119.3993	119.3993	119.1675	119.8814	120.6510	121.1950	121.7636 (38)
Average = $\text{Sum}(39)m / 12 =$	262.0289	261.7167	261.4108	259.9736	259.7047	258.4530	258.4530	258.2212	258.9351	259.7047	260.2487	260.8173 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0533	1.0520	1.0508	1.0450	1.0439	1.0389	1.0389	1.0379	1.0408	1.0439	1.0461	1.0484 (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 3.0653 (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 32.6404 32.1557 31.4730 30.2144 29.2719 28.2268 27.6624 28.3402 29.0783 30.1965 31.4811 32.5301 (42b)
 Hot water usage for other uses 46.0222 44.3487 42.6751 41.0016 39.3281 37.6545 37.6545 39.3281 41.0016 42.6751 44.3487 46.0222 (42c)
 Average daily hot water use (litres/day) 72.1012 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	78.6626	76.5043	74.1481	71.2159	68.5999	65.8814	65.3169	67.6683	70.0799	72.8716	75.8298	78.5523 (44)
Distribution loss (46) $m = 0.15 \times (45)m$	124.5823	108.9411	113.9629	97.4911	92.3487	81.0088	78.9951	83.7874	86.4155	98.8861	108.0334	122.9938 (45)
Total = $\text{Sum}(45)m =$	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 (61)

Total heat required for water heating calculated for each month
 WWHRs 105.8950 92.5999 96.8685 82.8674 78.4964 68.8575 67.1458 71.2193 73.4532 84.0532 91.8284 104.5448 (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 105.8950 92.5999 96.8685 82.8674 78.4964 68.8575 67.1458 71.2193 73.4532 84.0532 91.8284 104.5448 (64)

Total per year (kWh/year) = $\text{Sum}(64)m =$ 1017.8294 (64)
 1018 (64)
 12Total per year (kWh/year)
 Electric shower(s) 60.5555 53.9555 58.9173 56.2241 57.2791 54.6387 56.4600 57.2791 56.2241 58.9173 57.8094 60.5555 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = $\text{Sum}(64a)m =$ 688.8154 (64a)

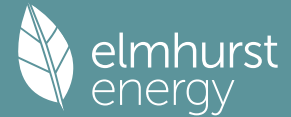
Heat gains from water heating, kWh/month
 41.6126 36.6389 38.9464 34.7729 33.9439 30.8740 30.9014 32.1246 32.4193 35.7426 37.4095 41.2751 (65)

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	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672	153.2672 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.4843	231.9290	209.4843	216.4671	209.4843	216.4671	209.4843	209.4843	216.4671	209.4843	216.4671	209.4843 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	415.3261	419.6358	408.7753	385.6546	356.4688	329.0382	310.7129	306.4032	317.2637	340.3844	369.5702	397.0008 (68)
Pumps, fans	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267	38.3267 (69)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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Losses e.g. evaporation (negative values) (Table 5)	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	-122.6138	(71)
Water heating gains (Table 5)	55.9309	54.5221	52.3474	48.2956	45.6235	42.8806	41.5342	43.1782	45.0268	48.0412	51.9576	55.4772	(72)
Total internal gains	749.7215	775.0672	739.5872	719.3975	680.5567	657.3661	630.7116	628.0458	647.7378	666.8901	706.9751	730.9425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
North	32.3000	10.6334	0.6300	0.7000	0.7700	104.9654	(74)						
East	6.2200	19.6403	0.6300	0.7000	0.7700	37.3344	(76)						
South	16.2100	46.7521	0.6300	0.7000	0.7700	231.6091	(78)						
West	3.1500	19.6403	0.6300	0.7000	0.7700	18.9073	(80)						
Solar gains	392.8162	689.9311	1005.2285	1357.8589	1630.4626	1668.7318	1587.8648	1375.5977	1125.2923	778.4581	474.1509	333.8864	(83)
Total gains	1142.5377	1464.9982	1744.8157	2077.2564	2311.0194	2326.0979	2218.5764	2003.6435	1773.0301	1445.3482	1181.1260	1064.8289	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	20.9150	20.9400	20.9645	21.0804	21.1022	21.2044	21.2044	21.2234	21.1649	21.1022	21.0581	21.0122	
tau	2.3943	2.3960	2.3976	2.4054	2.4068	2.4136	2.4136	2.4149	2.4110	2.4068	2.4039	2.4008	
util living area	0.9700	0.9466	0.9095	0.8346	0.7219	0.5799	0.4571	0.5108	0.7095	0.8829	0.9533	0.9744	(86)
MIT	17.8189	18.2466	18.8526	19.6206	20.2700	20.7012	20.8795	20.8389	20.4827	19.6075	18.5673	17.7379	(87)
Th 2	20.0392	20.0402	20.0412	20.0460	20.0469	20.0511	20.0511	20.0518	20.0495	20.0469	20.0451	20.0432	(88)
util rest of house	0.9661	0.9399	0.8978	0.8125	0.6835	0.5188	0.3741	0.4269	0.6557	0.8623	0.9462	0.9711	(89)
MIT 2	17.0989	17.5218	18.1181	18.8642	19.4722	19.8531	19.9904	19.9661	19.6797	18.8673	17.8469	17.0210	(90)
Living area fraction	17.2329	17.6567	18.2549	19.0050	19.6207	20.0110	20.1559	20.1285	19.8291	19.0051	17.9810	17.1545	(91)
MIT	17.2329	17.6567	18.2549	19.0050	19.6207	20.0110	20.1559	20.1285	19.8291	19.0051	17.9810	17.1545	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2329	17.6567	18.2549	19.0050	19.6207	20.0110	20.1559	20.1285	19.8291	19.0051	17.9810	17.1545	(93)

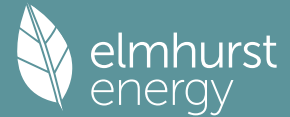
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9497	0.9170	0.8697	0.7839	0.6643	0.5160	0.3838	0.4342	0.6416	0.8340	0.9249	0.9563	(94)
Useful gains	1085.0310	1343.3384	1517.4453	1628.3309	1535.3063	1200.2553	851.5524	869.9865	1137.5736	1205.4101	1092.4683	1018.3170	(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	3388.7956	3338.6519	3072.8475	2627.0243	2057.0476	1398.4845	919.0444	962.7881	1483.4757	2182.8337	2831.7626	3378.7548	(97)
Space heating kWh	1714.0009	1340.8507	1157.2192	719.0592	388.1756	0.0000	0.0000	0.0000	0.0000	727.2032	1252.2919	1756.1658	(98a)
Space heating requirement - total per year (kWh/year)												9054.9664	
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	1714.0009	1340.8507	1157.2192	719.0592	388.1756	0.0000	0.0000	0.0000	0.0000	727.2032	1252.2919	1756.1658	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9054.9664	
Space heating per m2										(98c) / (4) =		36.3975	(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	2429.4581	1912.5521	1962.4810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7333	0.7944	0.7540	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1781.5594	1519.3769	1479.7991	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2620.5415	2498.8002	2251.8456	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	604.0671	728.6909	574.4026	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction													
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	151.0168	182.1727	143.6007	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												476.7902	(107)
Energy for space heating												36.3975	(99)
Energy for space cooling												1.9165	(108)

Full SAP Calculation Printout



Total Fabric Energy Efficiency (DFEE) 38.3140 (109)
38.3 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	248.7800 (1b)	x 2.8000 (2b)	= 696.5840 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	248.7800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 696.5840 (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	4 * 10 =	40.0000 (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) =	40.0000 / (5) =	0.0574 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3074 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3074 (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	0.3920	0.3843	0.3766	0.3382	0.3305	0.2921	0.2921	0.2844	0.3074	0.3305	0.3459	0.3612 (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	0.5768	0.5738	0.5709	0.5572	0.5546	0.5426	0.5426	0.5404	0.5473	0.5546	0.5598	0.5652 (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			2.9100	1.0000	2.9100		(26)
TER Opening Type (Uw = 1.20)			57.8800	1.1450	66.2748		(27)
EXTERNAL	131.7500	57.8800	73.8700	0.1800	13.2966		(29a)
HALLWAY	36.7400	2.9100	33.8300	0.1800	6.0894		(29a)
Flat Roof	227.9900		227.9900	0.1100	25.0789		(30)
External Roof 2	20.7900		20.7900	0.1100	2.2869		(30)
Total net area of external elements Aum(A, m ²)			417.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	115.9366	(33)

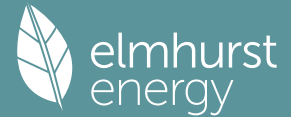
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

79.3039 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	25.0200	0.0500	1.2510
E3 Sill	7.1600	0.0500	0.3580
E4 Jamb	83.1800	0.0500	4.1590
E7 Party floor between dwellings (in blocks of flats)	49.7800	0.0700	3.4846
E14 Flat roof	85.1800	0.0800	6.8144
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	11.2000	-0.0900	-1.0080
E11 Eaves (insulation at rafter level)	37.7200	0.0400	1.5088
R1 Head of roof window	6.7800	0.0800	0.5424
R2 Sill of roof window	7.4100	0.0600	0.4446

Full SAP Calculation Printout



East		6.2200		19.6403		0.6300		0.7000		0.7700		37.3344 (76)
South		16.2100		46.7521		0.6300		0.7000		0.7700		231.6091 (78)
West		3.1500		19.6403		0.6300		0.7000		0.7700		18.9073 (80)

Solar gains	392.8162	689.9311	1005.2285	1357.8589	1630.4626	1668.7318	1587.8648	1375.5977	1125.2923	778.4581	474.1509	333.8864 (83)
Total gains	1142.5377	1464.9982	1744.8157	2077.2564	2311.0194	2326.0979	2218.5764	2003.6435	1773.0301	1445.3482	1181.1260	1064.8289 (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	20.4012	20.4534	20.5048	20.7499	20.7964	21.0157	21.0157	21.0568	20.9307	20.7964	20.7026	20.6053
alpha	2.3601	2.3636	2.3670	2.3833	2.3864	2.4010	2.4010	2.4038	2.3954	2.3864	2.3802	2.3737
util living area	0.9702	0.9472	0.9108	0.8366	0.7251	0.5825	0.4598	0.5132	0.7121	0.8841	0.9536	0.9745 (86)
MIT	17.7473	18.1788	18.7934	19.5855	20.2473	20.6937	20.8759	20.8350	20.4701	19.5794	18.5253	17.6819 (87)
Th 2	20.0174	20.0196	20.0219	20.0323	20.0342	20.0434	20.0434	20.0450	20.0398	20.0342	20.0303	20.0262 (88)
util rest of house	0.9662	0.9404	0.8990	0.8145	0.6866	0.5209	0.3759	0.4286	0.6580	0.8635	0.9465	0.9711 (89)
MIT 2	17.0145	17.4421	18.0478	18.8213	19.4422	19.8407	19.9810	19.9573	19.6614	18.8319	17.7963	16.9551 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	17.1509	17.5792	18.1866	18.9635	19.5921	19.9995	20.1476	20.1207	19.8120	18.9711	17.9320	17.0904 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1509	17.5792	18.1866	18.9635	19.5921	19.9995	20.1476	20.1207	19.8120	18.9711	17.9320	17.0904 (93)

8. Space heating requirement

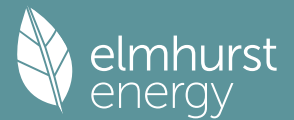
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9496	0.9172	0.8705	0.7854	0.6667	0.5179	0.3856	0.4358	0.6434	0.8348	0.9250	0.9562 (94)
Useful gains	1084.9043	1343.7114	1518.9354	1631.4343	1540.8284	1204.6650	855.5356	873.2178	1140.8456	1206.6391	1092.5880	1018.1785 (95)
Ext temp.	4.3000	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	3452.1285	3397.3111	3123.4732	2657.9200	2079.7499	1408.0432	925.1243	968.3629	1495.5803	2205.9715	2867.4300	3428.4155 (97)
Space heating kWh	1761.2148	1380.0190	1193.7761	739.0697	400.9576	0.0000	0.0000	0.0000	0.0000	743.5033	1277.8862	1793.2163 (98a)
Space heating requirement - total per year (kWh/year)												9289.6431
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	1761.2148	1380.0190	1193.7761	739.0697	400.9576	0.0000	0.0000	0.0000	0.0000	743.5033	1277.8862	1793.2163 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9289.6431
Space heating per m2												(98c) / (4) = 37.3408 (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	2451.2717	1929.7246	1978.0095	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7292	0.7906	0.7505	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1787.3574	1525.6535	1484.4127	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2620.5415	2498.8002	2251.8456	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	599.8925	724.0212	570.9701	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	149.9731	181.0053	142.7425	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												473.7209 (107)
Energy for space heating												37.3408 (99)
Energy for space cooling												1.9042 (108)
Total												39.2450 (109)
Fabric Energy Efficiency (TFEE)												39.2 (109)

Predicted Energy Assessment

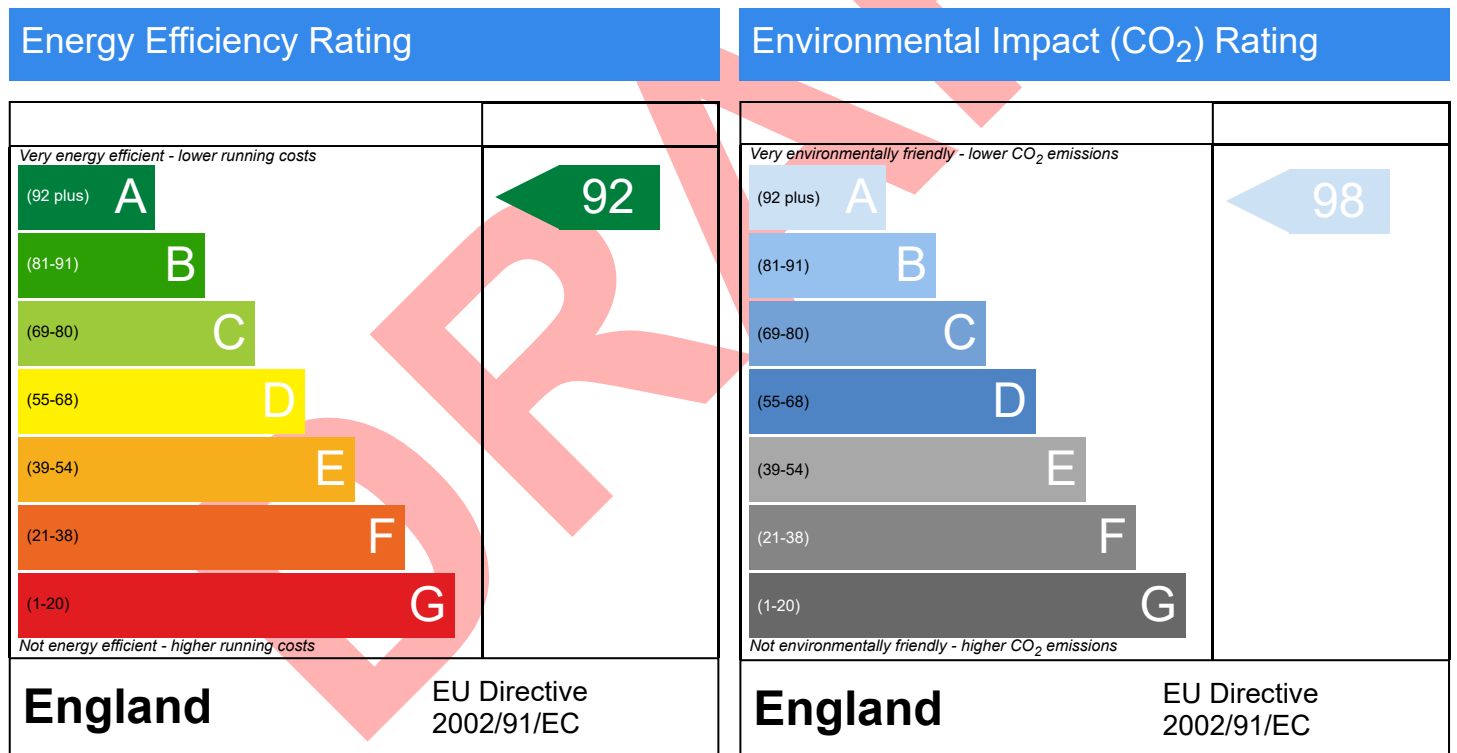


20, Watford Way, RADLETT, WD7 8LE

Dwelling type: Flat, Detached
 Date of assessment: 10/07/2023
 Produced by: Mark Simons
 Total floor area: 248.78 m²
 DRRN:

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.

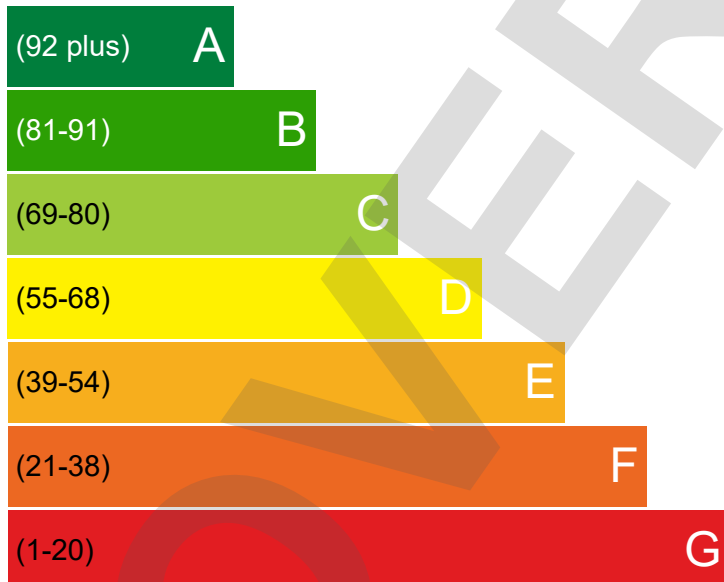
Dwelling Address	20, Watford Way, RADLETT, WD7 8LE
Report Date	10/07/2023
Property Type	Flat, Detached
Floor Area [m ²]	249

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs



CURRENT



POTENTIAL



Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:



Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Time and temperature zone control	Very Good
Secondary heating	None	
Hot water	From main system	Good
Lighting	Excelent lighting efficiency	Very Good
Air tightness	Air permeability [AP50] = 3.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 15 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.4** per year

With the recommended measures the potential CO emissions could be: **0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
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Estimated energy use and potential savings

Estimated energy cost for this property over a year

£511

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details	
Assessor name	Mr. Mark Simons
Assessor's accreditation number	EES/004083
Email Address	mark@ealconsult.com

Accreditation scheme contact details

Accreditation scheme	Elmhurst Energy Systems Ltd
Telephone	020 8930 5668
Email Address	mark@ealconsult.com

Assessment details

Related party disclosure	No related party
Date of assessment	10/07/2022
Date of certificate	10/07/2022
Type of assessment	SAP 10 dwelling

OVERVIEW