ENERGY ASSESSMENT

FORTESS ROAD

PROPERTY ADDRESS
3,5 & 7 FORTESS ROAD,
LONDON,
NW51AA,

DATE REV
July 2023

PREPARED BY
EAL Consult

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1. EXECUTIVE SUMMARY

This Sustainability statement has been prepared to support the planning application for the erection of 4 flats. A shop and a café in Kentish Town. The strategy highlights how the proposed development will promote sustainability throught 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 reponds to the UK Planning and regulatory framework, the National Planning Policy Framework 2021, the New London Plan 2021 and the Camden Local Plan 2017.

In accordance with the Energy Hierarchy detailed within The New London Plan 2021, this statement outlines an overall commitment to reducing energy consumption under occupancy through the adoption of a 'Fabric First' principle, which will seek enhanced insulation standards and improved heating and lighting efficiencies in comparison to the standard requirements of Approved Document Part L1 2021. Further carbon emission reduction can be achieved by using renewable - Photovoltaic Panels.

Energy Effcicency & Carbon Reduction:

- Passive design principles including a high level of insulation and reduced air permeabilty to deliver Part L1 2021 compliant Building in absence of renewable technologies.

- **Flats:** Heatpumps have been proposed for the specific scheme and will deliver a **75.7%** reduction in regulated carbon emissions over Part L baseline when utilising the proposed carbon factor changes to building Regulations Part L.

- **Commercial (shop & Café):** Photovoltaic Panels have been proposed for the commercials and will deliver a **47.4%** 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:

- **75.7% with the use of Air source heatpumps for the flats**
- **47.4% with the use of Photovoltaic panels for the commercial units.**

The following tables demonstrate the carbon emissions and savings.

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

	Regulated Carbon dioxide emissions (Tonnes CO2 per annum)	
	Regulated	Total
Building Regs Notional Development	4.19	5.03
After Energy demand Reduction	4.48	5.37
After Renewables	1.02	1.22

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

	Regulated Carbon dioxide savings (Tonnes CO_2)	% Reduction
Savings from energy efficiency measures	-0.8	**-6.8%**
Savings from Renewables	3.46	**82.4%**
Total savings	3.17	**75.7%**

Table 3. Carbon Dioxide emissions after each stage of the Energy Hierarchy for commercials

	Regulated Carbon dioxide emissions (Tonnes CO2 per annum)	
	Regulated	Total
Building Regs Notional Development	2	2.4
After Energy demand Reduction	2.2	2.64
After Renewables	1.05	1.26

Table 4. Carbon Dioxide Savings from each stage of the Energy Hierarchy for commercials

	Regulated Carbon dioxide savings (Tonnes CO_2)	% Reduction
Savings from energy efficiency measures	-0.2	**-10.1%**
Savings from Renewables	1.15	**57.4%**
Total savings	0.95	**47.4%**

2. INTRODUCTION

Site description

The development is located to the south end of Fortess Road as it connects with Highgate Road and Kentish Town RoadNumber 3 Fortess Road is occupied by a hot food Chinese takeaway at ground floor level and residential accommodation above that is accessed though the restaurant and via a separate entrance to the side. Numbers 5 and 7 Fortess Road are of similar architectural style to no. 3 but are currently vacant as a result of structural damage caused by the construction works done at no.s 1-34 to the north of the site.

Methodology

This energy assessment outlines the energy demand from the development together with the associated CO_2 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 CO_2 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.

The government approved Standard Assessment Procedure (SAP) methodology software (2013) has been used to determine the CO_2 emissions and energy requirements. It compares CO_2 emissions from regulated energy use (DER) with those of an equivalent dwelling built to Part L1A 2013 (TER), a notional dwelling of the same size and shape. These calculations do not include emissions from cooking or appliances.

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

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

The London Plan 2021 provides the strategic framework for an integrated socio-economic, transportation and environmental development plan across the capital to 2050. The Plan seeks to ensure new developments are designed to enable the efficient use of energy and support the development of sustainable energy infrastructure to produce energy more efficiently. It sets out a range of policies that apply to new developments.

Policy SI 2 Minimising Greenhouse Gas Emissions:

A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy: a) Be lean: use less energy and manage demand during operation, b) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly, c) Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.

B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either: 1) through a cash in lieu contribution to the borough's carbon offset fund, or 2) off-site provided that an alternative proposal is identified, and delivery is certain.

D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.
F. Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

9.2.1 The Mayor is committed to London becoming a zero-carbon city. This will require reduction of all greenhouse gases, of which carbon dioxide is the most prominent. London's homes and workplaces are responsible for producing approximately 78 per cent of its greenhouse gas emissions. If London is to achieve its objective of becoming a zero-carbon city by 2050, new development needs to meet the requirements of this policy. Development involving major refurbishment should also aim to meet this policy.

9.2.2 The energy hierarchy should inform the design, construction, and operation of new buildings. The priority is to minimise energy demand, and then address how energy will be supplied and renewable technologies incorporated. An important aspect of managing demand will be to reduce peak energy loadings.

Camden Local Plan 2017

Policy CC1 Climate change mitigation
The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.
We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
d. support and encourage sensitive energy efficiency improvements to existing buildings;
e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
f. expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and
low carbon technologies, major developments will be required to install
appropriate monitoring equipment.

4. ENERGY STRATEGY

The Energy strategy for the proposed housing is based on the Building Regulations Part L1A; 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.

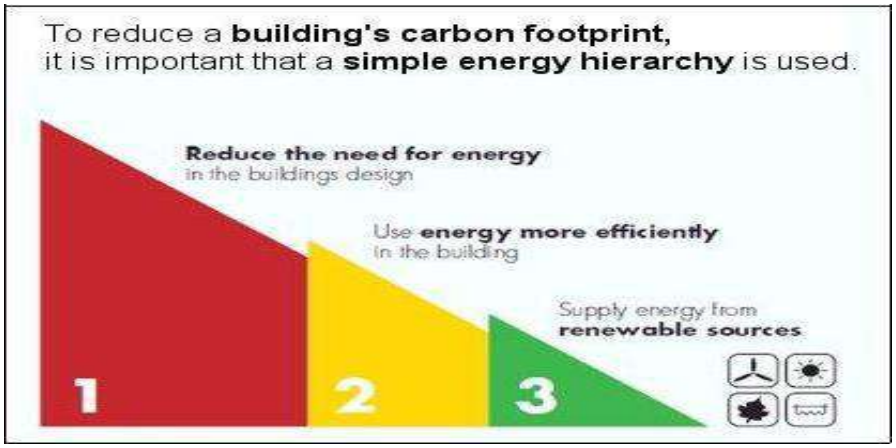

Figure 1. Energy Hierarchy

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.

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 5. Fabric energy Efficiency Standard

Thermal element	Part L1 Minimum Standard
Wall	0.18W/m^{2}k
Roof	0.11 W/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 6. Energy Efficient design Specification

Element	Standard	Specification
Wall	0.18 W/m²k	0.15W/m²k
Floor	0.13W/ m²k	0.13W/m²k
Roof	0.11 W/ m²k	0.11 W/ m²k
Glazing	1.2 W/ m²k	1.1 W/ m²k

Space Heating & Cooling - Space heating could be provided by underfloor heating.

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. Internal areas that are not frequently used will be fitted with occupant sensors.

Ventilation - The use of natural ventilation is proposed for the flats and mixed mode for ventilation for the commercials.

Domestic hot water (DHW) system – domestic hot water is supplied for 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.

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

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 photovoltaic panels.

Table 7. Renewable technologies

Technology	Pros	Cons
Biomass Heating A biomass system designed for wood pellets, which have a high-energy content, would fuel this development. 	• Less volume of storage • Less maintenance and produce considerably less ash residue	• Nox Emissions which may impacts • High Costs • Not suitable for the project
Ground Source Heat Pump It circulates a mixture of water and antifreeze around a loop of pipe, called a ground loop, which is buried in the garden. Heat from the ground is absorbed into the fluid and then passes through a heat exchanger into the heat pump. 	• Use all the year	• High Costs • Not suitable for this project
Air Source Heat Pump They are an efficient and environmentally-friendly way of heating using air drawn freely from the atmosphere. They operate rather like a refrigerator in reverse, absorbing heat from the air into a working fluid which is passed into a compressor where its temperature is increased before it is transferred into the heating and hot water circuits of the building.	• Can generates less CO_2 than conventional heating systems. • Cheaper • Provides heating and hot water • Less maintenance • Can be used as air-conditioning in the summer	• Needs electricity • Can be noisy

Wind Turbines Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings. 	• Cheaper • Less CO_2	• Local wind speeds in the area is likely to be below the level generally required for investment in large wind turbines. • Noise and signal interference. • Detrimental aesthetic impact
Photovoltaic Panels (PV) Photovoltaic panels extract the energy of the sun to generate electricity. They operate most efficiently when oriented to the south and are inclined to about 35 degrees. 	• Cheaper • Less CO_2 • No input power in order to generate electricity.	

On review of the above technologies, it has been concluded the following:

- **Commercials:** the use of Photovoltaic Panels will achieve a reduction of **47.4%** in carbon emission rate.
- **Flats:** the use of air source heat pumps for the flats.

	System size	Pitch	Orientation	No of Panels
Fortess Road (Commercials)	6.5 kWp	Horizontal	South facing	26

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 8. Water Fittings Standards

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

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 has been included at the back of the ground floor unit for the residents exclusive use. Composting is also considered to reduce the overall household.

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.

Urban Greening Factor

Due the constraints of the site and the lack of landscape, we can't assess the urban greening factor. However, we advise on installing green walls and/or green roofs which are the only options provided.

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 L1A building regulations requirements. In line with the national and local policies, regulated CO_2 emissions from the development will exceed the requirements defined by the UK Planning and regulatory framework, the National Planning Policy Framework 2021, the New London Plan 2021 and the Camden Local Plan 2017.
be reduced by **40.8%** from the notional emissions once energy efficiency measures and lean measures are taken into account.

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

- **75.7% with the use of Air source heatpumps for the flats**
- **47.4% with the use of Photovoltaic panels for the commercial units.**

In order to achieve the required carbon emissions reduction, the report concludes and proposes the use of energy efficient measures 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
II. SBEM

Building Regulations England Part L (BREL) Compliance Report

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

Date: Sun 02 Jul 2023 20:29:42

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/004083	Assessment Date	2023-07-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	85 m^2
Site Reference	Fortess Road	Plot Reference	Flat 1 - Boiler
Address	Flat 1 7 Fortess Road, LONDON, NW5 1AA		

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	*12.06 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	12.87 $kgCO_2/m^2$	**FAIL**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*64.05 kWh_{PE}/m^2*	
Dwelling primary energy	71.63 kWh_{PE}/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*31.9 kWh/m^2*	
Dwelling fabric energy efficiency	29.4 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	**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*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.1	Opening (1.1)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	43.25	0.15
Sheltered wall: Walls (2)	17.43	0.15
Party wall: Party Wall (1)	24.13	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Opening, WINDOWS	12.36	East	0.7	1.1 **(!)**
Opening, WINDOWS	1.98	West	0.7	1.1 **(!)**
Opening, WINDOWS	7.86	West	0.7	1.1 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
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	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	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	83.7%
Emitter type	Underfloor
Flow temperature	
System type	Combi boiler
Manufacturer	Vaillant
Model	ecoFIT sustain 835
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

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

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
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: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Summary for Input Data

elmhurst energy

Property Reference	Fortess Road	**Issued on Date**	02/07/2023
Assessment Reference	Flat 1 - Boiler	**Prop Type Ref**	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	**DER**	12.87	**TER**	12.06
Environmental	89 B	**% DER < TER**			-6.72
CO_2 Emissions (t/year)	0.96	**DFEE**	29.43	**TFEE**	31.89
Compliance Check	See BREL	**% DFEE < TFEE**			7.70
% DPER < TPER	-11.84	**DPER**	71.63	**TPER**	64.05

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

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

Orientation	East	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
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/m²K
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 m²	0.00 m
Ground floor:	1.00 m	85.19 m²	2.50 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	38.00	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	65.45	43.25	0.00	None	22.20	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	17.43	17.43	0.50	Stairwell Access Corridor 1	0.00	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	24.13	0.00	None

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	85.19

11.1 Party Floors

Summary for Input Data

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	85.19

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	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	WINDOWS	EXTERNAL	East	12.36	0
Opening	WINDOWS	EXTERNAL	West	1.98	0
Opening	WINDOWS	EXTERNAL	West	7.86	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	11.04	0.30	0.30	No
E3 Sill	Independently assessed	6.70	0.04	0.04	No
E4 Jamb	Independently assessed	47.42	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	66.30	0.07	0.07	No
E16 Corner (normal)	Independently assessed	2.50	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.50	-0.09	-0.09	No
E18 Party wall between dwellings	Independently assessed	7.50	0.06	0.06	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	19.30	0.00	0.00	No

Y-value	0.13	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP_{50}	0.10	m³/(h.m²) @ 50 Pa
19.0 Mechanical Ventilation		
Mechanical Ventilation		
Mechanical Ventilation System Present	No	
20.0 Fans, Open Fireplaces, Flues		
21.0 Fixed Cooling System	No	
22.0 Lighting		
No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	11

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	17960	
Fuel Type	Mains gas	
SAP Code	0	
In Winter	88.70	
In Summer	76.40	
Model Name	ecoFIT sustain 835	
Manufacturer	Vaillant	
System Type	Combi boiler	
Controls SAP Code	2110	
Delayed Start Stat	No	

Summary for Input Data

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	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Unknown
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2 None

26.0 Heat Networks 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
Bath Count	1
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 None

Cylinder Stat	No
Cylinder In Heated Space	No
Independent Time Control	No
In Airing Cupboard	No

31.0 Thermal Store None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 1 - Boiler	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	DER	12.87	TER	12.06
Environmental	89 B	% DER < TER			-6.72
CO_2 Emissions (t/year)	0.96	DFEE	29.43	TFEE	31.89
Compliance Check	See BREL	% DFEE < TFEE			7.70
% DPER < TPER	-11.84	DPER	71.63	TPER	64.05

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900	(1b)	x 2.5000	(2b) =	212.9750	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.9750	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2909 (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) =	0.2909 (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	0.3708	0.3636	0.3563	0.3199	0.3127	0.2763	0.2763	0.2690	0.2909	0.3127	0.3272	0.3418	(22b)
Effective ac	0.5688	0.5661	0.5635	0.5512	0.5489	0.5382	0.5382	0.5362	0.5423	0.5489	0.5535	0.5584	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1			85.1900			30.0000	2555.7000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14554.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 170.8452 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9738	39.7861	39.6021	38.7381	38.5765	37.8239	37.8239	37.6846	38.1138	38.5765	38.9035	39.2454	(38)
Heat transfer coeff	83.3343	83.1466	82.9626	82.0986	81.9370	81.1845	81.1845	81.0451	81.4743	81.9370	82.2640	82.6059	(39)

Average = Sum(39)m / 12 = 82.0979

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9782	0.9760	0.9739	0.9637	0.9618	0.9530	0.9530	0.9513	0.9564	0.9618	0.9657	0.9697	(40)
HLP (average)												0.9637	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5540 (42)
Hot water usage for mixer showers

67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851	(42a)

Hot water usage for baths

30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743	(42b)

Hot water usage for other uses

42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321	(42c)

Average daily hot water use (litres/day) 129.0969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)

Energy content (annual) Total = Sum(45)m = 2144.2662

Distribution loss (46)m = 0.15 x (45)m

33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(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 0.6428	0.5892	0.6491	0.5931	0.5928	0.5486	0.5417	0.5500	0.5416	0.5846	0.5970	0.6371	(61)

Total heat required for water heating calculated for each month

223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(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

223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)

Total per year (kWh/year) = Sum(64)m = 2151.3339 (64)
12Total per year (kWh/year) 2151 (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

74.1222	65.2171	68.5207	58.5100	55.5191	48.7307	47.1902	49.8159	51.1863	58.6216	64.2087	73.0929	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.9810	128.4076	115.9810	119.8471	115.9810	119.8471	115.9810	115.9810	119.8471	115.9810	119.8471	115.9810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.9454	232.3315	226.3186	213.5177	197.3590	182.1721	172.0263	169.6402	175.6531	188.4539	204.6127	219.7996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	(69)
Pumps, fans	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)	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)	99.6267	97.0492	92.0978	81.2639	74.6225	67.6816	63.4277	66.9568	71.0920	78.7925	89.1787	98.2432	(72)
Total internal gains	509.8631	522.0983	498.7074	478.9387	452.2725	431.0108	412.7451	413.8880	427.9022	447.5374	477.9485	498.3338	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887 (76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	643.1146	782.7665	927.9908	1105.0230	1219.5623	1216.4684	1160.5327	1056.2266	927.1766	756.8422	644.0974	607.9134	(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	48.5138	48.6233	48.7311	49.2440	49.3411	49.7985	49.7985	49.8841	49.6213	49.3411	49.1450	48.9416	
alpha	4.2343	4.2416	4.2487	4.2829	4.2894	4.3199	4.3199	4.3256	4.3081	4.2894	4.2763	4.2628	
util living area	0.9792	0.9546	0.8980	0.7652	0.5908	0.4209	0.3065	0.3504	0.5766	0.8557	0.9606	0.9831	(86)
MIT	19.6654	19.9635	20.3518	20.7402	20.9270	20.9866	20.9973	20.9953	20.9514	20.6403	20.0779	19.6131	(87)
Th 2	20.1015	20.1034	20.1052	20.1137	20.1153	20.1227	20.1227	20.1241	20.1198	20.1153	20.1121	20.1087	(88)
util rest of house	0.9748	0.9457	0.8795	0.7303	0.5430	0.3654	0.2460	0.2848	0.5124	0.8228	0.9513	0.9796	(89)
MIT 2	18.5509	18.9254	19.4019	19.8575	20.0537	20.1141	20.1216	20.1219	20.0851	19.7611	19.0801	18.4899	(90)
Living area fraction									fLA = Living area / (4) =			0.4461	(91)
MIT	19.0480	19.3885	19.8256	20.2512	20.4432	20.5033	20.5122	20.5115	20.4715	20.1533	19.5252	18.9909	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0480	19.3885	19.8256	20.2512	20.4432	20.5033	20.5122	20.5115	20.4715	20.1533	19.5252	18.9909	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9682	0.9372	0.8730	0.7360	0.5611	0.3897	0.2729	0.3140	0.5387	0.8243	0.9438	0.9737	(94)
Useful gains	622.6746	733.5985	810.1318	813.3379	684.2997	474.0213	316.7535	331.6606	499.4321	623.8960	607.8675	591.9259	(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	1229.0174	1204.6675	1105.5298	931.9174	716.3951	479.2522	317.6093	333.2158	519.1146	782.7652	1022.1435	1221.8165	(97)
Space heating kWh	451.1191	316.5584	219.7761	85.3772	23.8789	0.0000	0.0000	0.0000	0.0000	118.1987	298.2787	468.6386	(98a)
Space heating requirement - total per year (kWh/year)												1981.8257	
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	451.1191	316.5584	219.7761	85.3772	23.8789	0.0000	0.0000	0.0000	0.0000	118.1987	298.2787	468.6386	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1981.8257	
Space heating per m2											(98c) / (4) =	23.2636	(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 %) 83.7000 (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	451.1191	316.5584	219.7761	85.3772	23.8789	0.0000	0.0000	0.0000	0.0000	118.1987	298.2787	468.6386	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	538.9714	378.2059	262.5760	102.0039	28.5292	0.0000	0.0000	0.0000	0.0000	141.2171	356.3664	559.9027	(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	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)
Efficiency of water heater												76.4000	(216)
(217)m	84.2139	83.5516	82.2866	80.0231	77.7479	76.4000	76.4000	76.4000	76.4000	80.9003	83.4197	84.3612	(217)
Fuel for water heating, kWh/month													

	264.9012	234.9301	250.6342	220.0829	214.9536	192.0088	185.9422	196.2809	201.6728	218.1088	231.6683	260.7673 (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	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471 (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	2367.7726 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2671.9510 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	5306.6970 (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	2367.7726	0.2100	497.2322	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2671.9510	0.2100	561.1097	(264)
Space and water heating			1058.3420	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	180.9734	0.1443	26.1200	(268)
Total CO2, kg/year			1096.3913	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.8700	(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	2367.7726	1.1300	2675.5830	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2671.9510	1.1300	3019.3047	(278)
Space and water heating			5694.8877	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	180.9734	1.5338	277.5830	(282)
Total Primary energy kWh/year			6102.5715	(286)
Dwelling Primary energy Rate (DPER)			71.6300	(287)

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

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1. Overall dwelling characteristics

	Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	85.1900 (1b)	x	2.5000 (2b)	=	212.9750 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9750	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3909	(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) =	0.3909	(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	0.4983	0.4886	0.4788	0.4299	0.4202	0.3713	0.3713	0.3615	0.3909	0.4202	0.4397	0.4593	(22b)
Effective ac	0.6242	0.6194	0.6146	0.5924	0.5883	0.5689	0.5689	0.5654	0.5764	0.5883	0.5967	0.6055	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			21.3000	1.1450	24.3893			(27)
EXTERNAL	65.4500	21.3000	44.1500	0.1800	7.9470			(29a)
HALLWAY	17.4300		17.4300	0.1800	3.1374			(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.4737			(33)
Party Wall 1			24.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 180.8452 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.0500	0.5520
E3 Sill	6.7000	0.0500	0.3350
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3490 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 43.8227 (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	43.8682	43.5293	43.1971	41.6368	41.3449	39.9860	39.9860	39.7344	40.5094	41.3449	41.9355	42.5529	(38)
Heat transfer coeff	87.6909	87.3520	87.0198	85.4596	85.1676	83.8087	83.8087	83.5571	84.3322	85.1676	85.7582	86.3756	(39)
Average = Sum(39)m / 12 =												85.4582	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0294	1.0254	1.0215	1.0032	0.9997	0.9838	0.9838	0.9808	0.9899	0.9997	1.0067	1.0139	(40)
HLP (average)												1.0031	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5540 (42)

Hot water usage for mixer showers

67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851 (42a)

Hot water usage for baths

28.9535	28.5235	27.9179	26.8014	25.9654	25.0384	24.5377	25.1390	25.7937	26.7856	27.9251	28.8556 (42b)

Hot water usage for other uses

	40.7855	39.3024	37.8193	36.3362	34.8531	33.3700	33.3700	34.8531	36.3362	37.8193	39.3024	40.7855 (42c)

Average daily hot water use (litres/day) 125.7326 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	136.7809	133.8603	130.3035	124.8949	120.5028	115.7809	113.9662	117.5076	121.2426	126.1998	131.6917	136.4262	(44)
Energy conte	216.6275	190.6153	200.2716	170.9749	162.2199	142.3661	137.8322	145.4989	149.5042	171.2519	187.6190	213.6104	(45)
Energy content (annual)										Total = Sum(45)m =		2088.3920	
Distribution loss (46)m = 0.15 x (45)m													
	32.4941	28.5923	30.0407	25.6462	24.3330	21.3549	20.6748	21.8248	22.4256	25.6878	28.1428	32.0416	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	267.5864	236.6427	251.2306	220.2899	213.1788	191.6812	188.7911	196.4579	198.8193	222.2108	236.9340	264.5693	(62)
WWHRS	-30.6488	-27.1060	-28.3839	-23.5030	-21.9039	-18.7433	-17.5689	-18.6828	-19.3926	-22.8617	-25.8995	-30.0812	(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													
	236.9377	209.5366	222.8467	196.7870	191.2749	172.9379	171.2222	177.7751	179.4267	199.3491	211.0345	234.4881	(64)
										Total per year (kWh/year) = Sum(64)m =		2403.6164	(64)
12Total per year (kWh/year)												2404	(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													
	84.7684	74.8864	79.3300	69.1779	66.6778	59.6655	58.5689	61.1181	62.0389	69.6810	74.7121	83.7652	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	115.9810	128.4076	115.9810	119.8471	115.9810	119.8471	115.9810	115.9810	119.8471	115.9810	119.8471	115.9810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.9454	232.3315	226.3186	213.5177	197.3590	182.1721	172.0263	169.6402	175.6531	188.4539	204.6127	219.7996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	(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)													
	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)													
	113.9360	111.4381	106.6264	96.0804	89.6208	82.8688	78.7217	82.1480	86.1652	93.6572	103.7668	112.5876	(72)
Total internal gains													
	524.1724	536.4872	513.2360	493.7553	467.2708	446.1979	428.0390	429.0793	442.9754	462.4022	492.5365	512.6782	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.8600	19.6403	0.6300	0.7000	0.7700	71.1875	(76)
West	9.4400	19.6403	0.6300	0.7000	0.7700	56.6619	(80)

Solar gains	127.8494	250.1006	411.8800	600.7025	736.1834	753.6147	717.4719	616.2978	479.0335	296.7654	159.4132	105.1371	(83)
Total gains	652.0218	786.5878	925.1161	1094.4577	1203.4543	1199.8127	1145.5110	1045.3771	922.0089	759.1676	651.9497	617.8154	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.8021	48.9914	49.1785	50.0763	50.2480	51.0627	51.0627	51.2165	50.7458	50.2480	49.9019	49.5453	
alpha	4.2535	4.2661	4.2786	4.3384	4.3499	4.4042	4.4042	4.4144	4.3831	4.3499	4.3268	4.3030	
util living area													
	0.9820	0.9612	0.9122	0.7889	0.6173	0.4398	0.3204	0.3649	0.5973	0.8699	0.9653	0.9853	(86)
MIT	19.6343	19.9214	20.3062	20.7155	20.9180	20.9855	20.9971	20.9951	20.9479	20.6239	20.0624	19.5989	(87)
Th 2	20.0589	20.0622	20.0655	20.0807	20.0836	20.0969	20.0969	20.0993	20.0917	20.0836	20.0778	20.0718	(88)
util rest of house													
	0.9779	0.9530	0.8947	0.7538	0.5668	0.3805	0.2554	0.2947	0.5296	0.8374	0.9565	0.9819	(89)
MIT 2	18.4763	18.8387	19.3139	19.8013	20.0152	20.0878	20.0957	20.0972	20.0552	19.7152	19.0316	18.4406	(90)
Living area fraction										fLA = Living area / (4) =		0.4461	(91)
MIT	18.9928	19.3217	19.7565	20.2091	20.4179	20.4882	20.4978	20.4977	20.4534	20.1206	19.4914	18.9572	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9928	19.3217	19.7565	20.2091	20.4179	20.4882	20.4978	20.4977	20.4534	20.1206	19.4914	18.9572	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9720	0.9450	0.8881	0.7590	0.5857	0.4064	0.2844	0.3259	0.5573	0.8388	0.9496	0.9767	(94)
Useful gains	633.7379	743.3501	821.5496	830.6552	704.8410	487.6307	325.7390	340.7183	513.8211	636.8109	619.0856	603.3976	(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	1288.4271	1259.7616	1153.5807	966.4705	742.4823	493.4846	326.6702	342.3906	535.7932	810.8438	1062.6635	1274.6650	(97)
Space heating kWh	487.0887	347.0285	247.0311	97.7871	28.0051	0.0000	0.0000	0.0000	0.0000	129.4805	319.3761	499.4229	(98a)
Space heating requirement - total per year (kWh/year)												2155.2200	
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	487.0887	347.0285	247.0311	97.7871	28.0051	0.0000	0.0000	0.0000	0.0000	129.4805	319.3761	499.4229	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2155.2200	
Space heating per m2											(98c) / (4) =	25.2990	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.0887	347.0285	247.0311	97.7871	28.0051	0.0000	0.0000	0.0000	0.0000	129.4805	319.3761	499.4229	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	527.1523	375.5720	267.3497	105.8301	30.3086	0.0000	0.0000	0.0000	0.0000	140.1304	345.6451	540.5010	(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	236.9377	209.5366	222.8467	196.7870	191.2749	172.9379	171.2222	177.7751	179.4267	199.3491	211.0345	234.4881	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.8897	85.4544	84.6028	82.9642	81.3045	80.3000	80.3000	80.3000	80.3000	83.4799	85.2667	85.9586	(217)
Fuel for water heating, kWh/month	275.8626	245.2028	263.4035	237.1949	235.2575	215.3647	213.2282	221.3887	223.4455	238.7989	247.4994	272.7918	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.0986	19.3328	17.4070	12.7531	9.8509	8.0483	8.9863	11.6807	15.1721	19.9066	22.4845	24.7683	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.7415	-28.0323	-42.7171	-51.0077	-57.6319	-54.7498	-54.0717	-49.7277	-42.5520	-33.3278	-21.1643	-16.0202	(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	-6.2055	-13.3879	-27.2476	-41.8840	-56.3412	-56.9740	-56.3156	-47.2489	-34.0608	-19.4675	-8.3857	-4.8834	(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	2332.4892	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2889.4384	(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)	194.4893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-842.1458	(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		4660.2710 (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	2332.4892	0.2100	489.8227	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2889.4384	0.2100	606.7821	(264)
Space and water heating			1096.6048	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	194.4893	0.1443	28.0708	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7439	0.1334	-62.6497	
PV Unit electricity exported	-372.4019	0.1252	-46.6314	
Total			-109.2811	(269)
Total CO2, kg/year			1027.3238	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.0600	(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	2332.4892	1.1300	2635.7128	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2889.4384	1.1300	3265.0654	(278)
Space and water heating			5900.7782	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	194.4893	1.5338	298.3141	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7439	1.4928	-701.2541	
PV Unit electricity exported	-372.4019	0.4596	-171.1569	
Total			-872.4110	(283)
Total Primary energy kWh/year			5456.7821	(286)
Target Primary Energy Rate (TPER)			64.0500	(287)

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 1 - Boiler	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	DER	12.87	TER	12.06
Environmental	89 B	% DER < TER			-6.72
CO_2 Emissions (t/year)	0.96	DFEE	29.43	TFEE	31.89
Compliance Check	See BREL	% DFEE < TFEE			7.70
% DPER < TPER	-11.84	DPER	71.63	TPER	64.05

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 ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		85.1900 (1b)	x	2.5000 (2b)	=	212.9750 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9750	(5)

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2909	(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) =	0.2909	(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	0.3708	0.3636	0.3563	0.3199	0.3127	0.2763	0.2763	0.2690	0.2909	0.3127	0.3272	0.3418	(22b)
Effective ac	0.5688	0.5661	0.5635	0.5512	0.5489	0.5382	0.5382	0.5362	0.5423	0.5489	0.5535	0.5584	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1			85.1900			40.0000	3407.6000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15406.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 180.8452 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9738	39.7861	39.6021	38.7381	38.5765	37.8239	37.8239	37.6846	38.1138	38.5765	38.9035	39.2454	(38)
Heat transfer coeff	83.3343	83.1466	82.9626	82.0986	81.9370	81.1845	81.1845	81.0451	81.4743	81.9370	82.2640	82.6059	(39)

Average = Sum(39)m / 12 = 82.0979

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9782	0.9760	0.9739	0.9637	0.9618	0.9530	0.9530	0.9513	0.9564	0.9618	0.9657	0.9697	(40)
HLP (average)												0.9637	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5540 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851	(42a)
Hot water usage for baths	30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743	(42b)
Hot water usage for other uses	42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321	(42c)

Average daily hot water use (litres/day) 129.0969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)

Energy content (annual) Total = Sum(45)m = 2144.2662

Distribution loss (46)m = 0.15 x (45)m	33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(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	0.6428	0.5892	0.6491	0.5931	0.5928	0.5486	0.5417	0.5500	0.5416	0.5846	0.5970	0.6371	(61)
Total heat required for water heating calculated for each month	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(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	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)

Total per year (kWh/year) = Sum(64)m = 2151.3339 (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	74.1222	65.2171	68.5207	58.5100	55.5191	48.7307	47.1902	49.8159	51.1863	58.6216	64.2087	73.0929	(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	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6187	22.7543	18.5050	14.0095	10.4723	8.8411	9.5531	12.4175	16.6668	21.1623	24.6995	26.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.2021	346.7634	337.7889	318.6832	294.5657	271.8986	256.7557	253.1943	262.1688	281.2745	305.3920	328.0591	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	(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)	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)	99.6267	97.0492	92.0978	81.2639	74.6225	67.6816	63.4277	66.9568	71.0920	78.7925	89.1787	98.2432	(72)
Total internal gains	575.4054	573.5249	555.3497	520.9146	486.6184	452.3794	433.6945	436.5267	453.8857	488.1873	526.2283	559.5910	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887 (76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796 (83)
Total gains	708.6569	834.1932	984.6331	1146.9989	1253.9082	1237.8370	1181.4822	1078.8652	953.1600	797.4921	692.3773	669.1705 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3534	51.4693	51.5835	52.1263	52.2292	52.7133	52.7133	52.8039	52.5258	52.2292	52.0215	51.8062	
alpha	4.4236	4.4313	4.4389	4.4751	4.4819	4.5142	4.5142	4.5203	4.5017	4.4819	4.4681	4.4537	
util living area	0.9746	0.9498	0.8876	0.7542	0.5804	0.4149	0.3014	0.3437	0.5660	0.8436	0.9552	0.9795	(86)
MIT	19.8238	20.0829	20.4474	20.7840	20.9422	20.9898	20.9981	20.9966	20.9618	20.6978	20.1887	19.7688	(87)
Th 2	20.1015	20.1034	20.1052	20.1137	20.1153	20.1227	20.1227	20.1241	20.1198	20.1153	20.1121	20.1087	(88)
util rest of house	0.9691	0.9398	0.8672	0.7180	0.5323	0.3598	0.2418	0.2791	0.5017	0.8082	0.9445	0.9751	(89)
MIT 2	18.7452	19.0692	19.5128	19.9040	20.0675	20.1164	20.1219	20.1226	20.0933	19.8233	19.2127	18.6813	(90)
Living area fraction									fLA = Living area / (4) =			0.4461	(91)
MIT	19.2263	19.5214	19.9297	20.2965	20.4577	20.5060	20.5128	20.5125	20.4807	20.2134	19.6480	19.1664	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2263	19.5214	19.9297	20.2965	20.4577	20.5060	20.5128	20.5125	20.4807	20.2134	19.6480	19.1664	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9321	0.8628	0.7258	0.5512	0.3840	0.2683	0.3079	0.5286	0.8125	0.9377	0.9691	(94)
Useful gains	682.0880	777.5322	849.4986	832.5360	691.1843	475.3903	317.0365	332.1540	503.8644	647.9558	649.2447	648.5018	(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	1243.8755	1215.7170	1114.1634	935.6396	717.5773	479.4726	317.6545	333.2944	519.8619	787.6909	1032.2505	1236.3138	(97)
Space heating kWh	417.9699	294.4602	196.9107	74.2346	19.6364	0.0000	0.0000	0.0000	0.0000	103.9629	275.7641	437.3321	(98a)
Space heating requirement - total per year (kWh/year)												1820.2709	
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	417.9699	294.4602	196.9107	74.2346	19.6364	0.0000	0.0000	0.0000	0.0000	103.9629	275.7641	437.3321	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1820.2709	
Space heating per m2										(98c) / (4) =		21.3672	(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 %)	83.7000	(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	417.9699	294.4602	196.9107	74.2346	19.6364	0.0000	0.0000	0.0000	0.0000	103.9629	275.7641	437.3321	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	499.3667	351.8043	235.2577	88.6912	23.4604	0.0000	0.0000	0.0000	0.0000	124.2090	329.4673	522.4995	(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	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)
Efficiency of water heater												76.4000	(216)
(217)m	83.9942	83.3338	81.9506	79.6762	77.5304	76.4000	76.4000	76.4000	76.4000	80.5407	83.1820	84.1651	(217)
Fuel for water heating, kWh/month	265.5940	235.5441	251.6620	221.0411	215.5565	192.0088	185.9422	196.2809	201.6728	219.0824	232.3303	261.3748	(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	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471 (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	2174.7561 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2678.0900 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	5119.8195 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2174.7561	3.6400	79.1611	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2678.0900	3.6400	97.4825	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	180.9734	16.4900	29.8425	(250)
Additional standing charges			92.0000	(251)
Total energy cost			312.6675	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8646 (257)
SAP value		85.9851
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2174.7561	0.2100	456.6988	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2678.0900	0.2100	562.3989	(264)
Space and water heating			1019.0977	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	180.9734	0.1443	26.1200	(268)
Total CO2, kg/year			1057.1470	(272)
CO2 emissions per m2			12.4100	(273)
EI value			89.1192	
EI rating			89	(274)
EI band			B	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900 (1b)	x	2.5000 (2b)	=	212.9750	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9750	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2909	(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) =	0.2909	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3345	0.3199	0.3199	0.2909	0.2909	0.2545	0.2690	0.2690	0.2690	0.2836	0.2836	0.3127	(22b)
Effective ac	0.5559	0.5512	0.5512	0.5423	0.5423	0.5324	0.5362	0.5362	0.5362	0.5402	0.5402	0.5489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1			85.1900			40.0000	3407.6000	(32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15406.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							180.8452	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	43.3605	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.0726	38.7381	38.7381	38.1138	38.1138	37.4170	37.6846	37.6846	37.6846	37.9670	37.9670	38.5765	(38)
Heat transfer coeff	82.4331	82.0986	82.0986	81.4743	81.4743	80.7775	81.0451	81.0451	81.0451	81.3275	81.3275	81.9370	(39)
Average = Sum(39)m / 12 =												81.5070	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9676	0.9637	0.9637	0.9564	0.9564	0.9482	0.9513	0.9513	0.9513	0.9547	0.9547	0.9618	(40)
HLP (average)												0.9568	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5540 (42)
Hot water usage for mixer showers												
	67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851 (42a)
Hot water usage for baths												
	30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743 (42b)
Hot water usage for other uses												
	42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321 (42c)
Average daily hot water use (litres/day)												129.0969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)
Energy content (annual)										Total = Sum(45)m =		2144.2662	
Distribution loss (46)m = 0.15 x (45)m													
	33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(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	0.6428	0.5892	0.6491	0.5931	0.5928	0.5486	0.5417	0.5500	0.5416	0.5846	0.5970	0.6371	(61)
Total heat required for water heating calculated for each month													
	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(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													
	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)
										Total per year (kWh/year) = Sum(64)m =		2151.3339	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
	74.1222	65.2171	68.5207	58.5100	55.5191	48.7307	47.1902	49.8159	51.1863	58.6216	64.2087	73.0929	(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	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6187	22.7543	18.5050	14.0095	10.4723	8.8411	9.5531	12.4175	16.6668	21.1623	24.6995	26.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	343.2021	346.7634	337.7889	318.6832	294.5657	271.8986	256.7557	253.1943	262.1688	281.2745	305.3920	328.0591	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	(69)
Pumps, fans	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)													
	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)													
	99.6267	97.0492	92.0978	81.2639	74.6225	67.6816	63.4277	66.9568	71.0920	78.7925	89.1787	98.2432	(72)
Total internal gains													
	575.4054	573.5249	555.3497	520.9146	486.6184	452.3794	433.6945	436.5267	453.8857	488.1873	526.2283	559.5910	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	721.8643	830.6059	979.4300	1157.3327	1243.8517	1279.1697	1219.1521	1133.8541	994.7512	821.1524	714.8004	677.8349	(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	51.9148	52.1263	52.1263	52.5258	52.5258	52.9788	52.8039	52.8039	52.8039	52.6206	52.6206	52.2292	
alpha	4.4610	4.4751	4.4751	4.5017	4.5017	4.5319	4.5203	4.5203	4.5203	4.5080	4.5080	4.4819	
util living area													
	0.9651	0.9394	0.8561	0.6875	0.4868	0.2897	0.1728	0.2000	0.4339	0.7634	0.9325	0.9718	(86)
MIT	20.0089	20.2127	20.5872	20.8717	20.9768	20.9984	20.9999	20.9998	20.9898	20.8364	20.3819	19.9565	(87)
Th 2	20.1104	20.1137	20.1137	20.1198	20.1198	20.1267	20.1241	20.1241	20.1241	20.1213	20.1213	20.1153	(88)
util rest of house													
	0.9575	0.9270	0.8301	0.6447	0.4340	0.2351	0.1146	0.1375	0.3660	0.7139	0.9162	0.9654	(89)
MIT 2	18.9849	19.2384	19.6860	20.0031	20.1032	20.1260	20.1241	20.1240	20.1185	19.9781	19.4577	18.9236	(90)
Living area fraction									fLA = Living area / (4) =			0.4461	(91)
MIT	19.4417	19.6730	20.0880	20.3905	20.4929	20.5151	20.5147	20.5147	20.5072	20.3609	19.8699	19.3843	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4417	19.6730	20.0880	20.3905	20.4929	20.5151	20.5147	20.5147	20.5072	20.3609	19.8699	19.3843	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9504	0.9199	0.8292	0.6583	0.4566	0.2594	0.1406	0.1654	0.3960	0.7282	0.9108	0.9588	(94)
Useful gains	686.0926	764.0429	812.1727	761.8667	567.9264	331.8619	171.3683	187.5472	393.8925	597.9390	651.0122	649.9404	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W													
	1157.4972	1138.9535	1008.8283	822.1192	577.8857	332.4100	171.3891	187.5932	397.7018	671.8403	940.9551	1145.8331	(97)
Space heating kWh													
	350.7250	251.9400	146.3118	43.3818	7.4097	0.0000	0.0000	0.0000	0.0000	54.9826	208.7589	368.9442	(98a)
Space heating requirement - total per year (kWh/year)												1432.4540	
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													
	350.7250	251.9400	146.3118	43.3818	7.4097	0.0000	0.0000	0.0000	0.0000	54.9826	208.7589	368.9442	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1432.4540	
Space heating per m2											(98c) / (4) =	16.8148	(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 %)	83.7000	(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													
	350.7250	251.9400	146.3118	43.3818	7.4097	0.0000	0.0000	0.0000	0.0000	54.9826	208.7589	368.9442	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	419.0263	301.0035	174.8050	51.8301	8.8527	0.0000	0.0000	0.0000	0.0000	65.6901	249.4133	440.7935	(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													
	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)
Efficiency of water heater												76.4000	(216)
(217)m	83.4752	82.8583	81.0652	78.5529	76.8524	76.4000	76.4000	76.4000	76.4000	79.0027	82.3283	83.6684	(217)
Fuel for water heating, kWh/month													
	267.2452	236.8959	254.4104	224.2020	217.4581	192.0088	185.9422	196.2809	201.6728	223.3475	234.7393	262.9266	(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	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471	(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												1711.4146	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2697.1297 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	4675.5177 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1711.4146	3.5000	59.8995 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2697.1297	3.5000	94.3995 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154 (249)
Energy for lighting	180.9734	18.3900	33.2810 (250)
Additional standing charges			94.0000 (251)
Total energy cost			297.3955 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1711.4146	0.2100	359.3971 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2697.1297	0.2100	566.3972 (264)
Space and water heating			925.7943 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	180.9734	0.1443	26.1200 (268)
Total CO2, kg/year			963.8436 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1711.4146	1.1300	1933.8985 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2697.1297	1.1300	3047.7566 (278)
Space and water heating			4981.6551 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	180.9734	1.5338	277.5830 (282)
Total Primary energy kWh/year			5389.3389 (286)

SAP 10 EPC IMPROVEMENTS

Flat 1 - Boiler

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 89

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: B 86
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£49	£49	£0
Mains gas	£248	£248	£0
Space heating	£170	£170	£0
Water heating	£94	£94	£0
Lighting	£33	£33	£0
Total cost of fuels	£297	£297	£0
Total cost of uses	£297	£297	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900 (1b)	x	2.5000 (2b)	=	212.9750 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9750	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2909	(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) =	0.2909	(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	0.3708	0.3636	0.3563	0.3199	0.3127	0.2763	0.2763	0.2690	0.2909	0.3127	0.3272	0.3418	(22b)
Effective ac	0.5688	0.5661	0.5635	0.5512	0.5489	0.5382	0.5382	0.5362	0.5423	0.5489	0.5535	0.5584	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)

Total net area of external elements Aum(A, m2)	82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	32.3185				(33)
Party Wall 1	24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1	85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1	85.1900			40.0000	3407.6000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15406.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		180.8452 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9738	39.7861	39.6021	38.7381	38.5765	37.8239	37.8239	37.6846	38.1138	38.5765	38.9035	39.2454	(38)
Heat transfer coeff	83.3343	83.1466	82.9626	82.0986	81.9370	81.1845	81.1845	81.0451	81.4743	81.9370	82.2640	82.6059	(39)
Average = Sum(39)m / 12 =												82.0979	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9782	0.9760	0.9739	0.9637	0.9618	0.9530	0.9530	0.9513	0.9564	0.9618	0.9657	0.9697	(40)
HLP (average)												0.9637	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5540 (42)
Hot water usage for mixer showers	67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851 (42a)
Hot water usage for baths	30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743 (42b)
Hot water usage for other uses	42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321 (42c)
Average daily hot water use (litres/day)												129.0969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)
Energy content (annual)										Total = Sum(45)m =		2144.2662	
Distribution loss (46)m = 0.15 x (45)m	33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(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	0.6428	0.5892	0.6491	0.5931	0.5928	0.5486	0.5417	0.5500	0.5416	0.5846	0.5970	0.6371	(61)
Total heat required for water heating calculated for each month	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(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	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)
										Total per year (kWh/year) = Sum(64)m =		2151.3339	(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	74.1222	65.2171	68.5207	58.5100	55.5191	48.7307	47.1902	49.8159	51.1863	58.6216	64.2087	73.0929	(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	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6187	22.7543	18.5050	14.0095	10.4723	8.8411	9.5531	12.4175	16.6668	21.1623	24.6995	26.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.2021	346.7634	337.7889	318.6832	294.5657	271.8986	256.7557	253.1943	262.1688	281.2745	305.3920	328.0591	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	(69)
Pumps, fans	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)	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)

Water heating gains (Table 5)

	99.6267	97.0492	92.0978	81.2639	74.6225	67.6816	63.4277	66.9568	71.0920	78.7925	89.1787	98.2432 (72)

Total internal gains

	575.4054	573.5249	555.3497	520.9146	486.6184	452.3794	433.6945	436.5267	453.8857	488.1873	526.2283	559.5910 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887 (76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796 (83)
Total gains	708.6569	834.1932	984.6331	1146.9989	1253.9082	1237.8370	1181.4822	1078.8652	953.1600	797.4921	692.3773	669.1705 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3534	51.4693	51.5835	52.1263	52.2292	52.7133	52.7133	52.8039	52.5258	52.2292	52.0215	51.8062	
alpha	4.4236	4.4313	4.4389	4.4751	4.4819	4.5142	4.5142	4.5203	4.5017	4.4819	4.4681	4.4537	
util living area													
	0.9746	0.9498	0.8876	0.7542	0.5804	0.4149	0.3014	0.3437	0.5660	0.8436	0.9552	0.9795	(86)
MIT	19.8238	20.0829	20.4474	20.7840	20.9422	20.9898	20.9981	20.9966	20.9618	20.6978	20.1887	19.7688	(87)
Th 2	20.1015	20.1034	20.1052	20.1137	20.1153	20.1227	20.1227	20.1241	20.1198	20.1153	20.1121	20.1087	(88)
util rest of house													
	0.9691	0.9398	0.8672	0.7180	0.5323	0.3598	0.2418	0.2791	0.5017	0.8082	0.9445	0.9751	(89)
MIT 2	18.7452	19.0692	19.5128	19.9040	20.0675	20.1164	20.1219	20.1226	20.0933	19.8233	19.2127	18.6813	(90)
Living area fraction										fLA = Living area / (4) =		0.4461	(91)
MIT	19.2263	19.5214	19.9297	20.2965	20.4577	20.5060	20.5128	20.5125	20.4807	20.2134	19.6480	19.1664	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2263	19.5214	19.9297	20.2965	20.4577	20.5060	20.5128	20.5125	20.4807	20.2134	19.6480	19.1664	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9321	0.8628	0.7258	0.5512	0.3840	0.2683	0.3079	0.5286	0.8125	0.9377	0.9691	(94)
Useful gains	682.0880	777.5322	849.4986	832.5360	691.1843	475.3903	317.0365	332.1540	503.8644	647.9558	649.2447	648.5018	(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													
	1243.8755	1215.7170	1114.1634	935.6396	717.5773	479.4726	317.6545	333.2944	519.8619	787.6909	1032.2505	1236.3138	(97)
Space heating kWh													
	417.9699	294.4602	196.9107	74.2346	19.6364	0.0000	0.0000	0.0000	0.0000	103.9629	275.7641	437.3321	(98a)
Space heating requirement - total per year (kWh/year)												1820.2709	
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													
	417.9699	294.4602	196.9107	74.2346	19.6364	0.0000	0.0000	0.0000	0.0000	103.9629	275.7641	437.3321	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1820.2709	
Space heating per m2											(98c) / (4) =	21.3672	(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 %)	83.7000	(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													
	417.9699	294.4602	196.9107	74.2346	19.6364	0.0000	0.0000	0.0000	0.0000	103.9629	275.7641	437.3321	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	499.3667	351.8043	235.2577	88.6912	23.4604	0.0000	0.0000	0.0000	0.0000	124.2090	329.4673	522.4995	(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

	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865 (64)
Efficiency of water heater												76.4000 (216)
(217)m	83.9942	83.3338	81.9506	79.6762	77.5304	76.4000	76.4000	76.4000	76.4000	80.5407	83.1820	84.1651 (217)
Fuel for water heating, kWh/month												
	265.5940	235.5441	251.6620	221.0411	215.5565	192.0088	185.9422	196.2809	201.6728	219.0824	232.3303	261.3748 (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	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471 (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	2174.7561 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2678.0900 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	5119.8195 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2174.7561	3.6400	79.1611	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2678.0900	3.6400	97.4825	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	180.9734	16.4900	29.8425	(250)
Additional standing charges			92.0000	(251)
Total energy cost			312.6675	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8646 (257)
SAP value		85.9851
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2174.7561	0.2100	456.6988	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2678.0900	0.2100	562.3989	(264)
Space and water heating			1019.0977	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	180.9734	0.1443	26.1200	(268)
Total CO2, kg/year			1057.1470	(272)
CO2 emissions per m2			12.4100	(273)
EI value			89.1192	
EI rating			89	(274)
EI band			B	

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		85.1900 (1b)	x	2.5000 (2b)	=	212.9750 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9750	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2909 (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) =	0.2909 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3345	0.3199	0.3199	0.2909	0.2909	0.2545	0.2690	0.2690	0.2690	0.2836	0.2836	0.3127	(22b)
Effective ac	0.5559	0.5512	0.5512	0.5423	0.5423	0.5324	0.5362	0.5362	0.5362	0.5402	0.5402	0.5489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1			85.1900			40.0000	3407.6000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15406.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		180.8452 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.0726	38.7381	38.7381	38.1138	38.1138	37.4170	37.6846	37.6846	37.6846	37.9670	37.9670	38.5765	(38)
Heat transfer coeff													
	82.4331	82.0986	82.0986	81.4743	81.4743	80.7775	81.0451	81.0451	81.0451	81.3275	81.3275	81.9370	(39)
Average = Sum(39)m / 12 =												81.5070	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9676	0.9637	0.9637	0.9564	0.9564	0.9482	0.9513	0.9513	0.9513	0.9547	0.9547	0.9618	(40)
HLP (average)												0.9568	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5540	(42)
Hot water usage for mixer showers													
	67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851	(42a)
Hot water usage for baths													
	30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743	(42b)
Hot water usage for other uses													
	42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321	(42c)
Average daily hot water use (litres/day)												129.0969	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)
Energy content (annual)										Total = Sum(45)m =		2144.2662	
Distribution loss (46)m = 0.15 x (45)m													
	33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(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	0.6428	0.5892	0.6491	0.5931	0.5928	0.5486	0.5417	0.5500	0.5416	0.5846	0.5970	0.6371	(61)
Total heat required for water heating calculated for each month													
	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(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													
	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)
										Total per year (kWh/year) = Sum(64)m =		2151.3339	(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													
	74.1222	65.2171	68.5207	58.5100	55.5191	48.7307	47.1902	49.8159	51.1863	58.6216	64.2087	73.0929	(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	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6187	22.7543	18.5050	14.0095	10.4723	8.8411	9.5531	12.4175	16.6668	21.1623	24.6995	26.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	343.2021	346.7634	337.7889	318.6832	294.5657	271.8986	256.7557	253.1943	262.1688	281.2745	305.3920	328.0591	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	(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)													
	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)													
	99.6267	97.0492	92.0978	81.2639	74.6225	67.6816	63.4277	66.9568	71.0920	78.7925	89.1787	98.2432	(72)
Total internal gains													
	575.4054	573.5249	555.3497	520.9146	486.6184	452.3794	433.6945	436.5267	453.8857	488.1873	526.2283	559.5910	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	721.8643	830.6059	979.4300	1157.3327	1243.8517	1279.1697	1219.1521	1133.8541	994.7512	821.1524	714.8004	677.8349	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.9148	52.1263	52.1263	52.5258	52.5258	52.9788	52.8039	52.8039	52.8039	52.6206	52.6206	52.2292	
alpha	4.4610	4.4751	4.4751	4.5017	4.5017	4.5319	4.5203	4.5203	4.5203	4.5080	4.5080	4.4819	
util living area	0.9651	0.9394	0.8561	0.6875	0.4868	0.2897	0.1728	0.2000	0.4339	0.7634	0.9325	0.9718	(86)
MIT	20.0089	20.2127	20.5872	20.8717	20.9768	20.9984	20.9999	20.9998	20.9898	20.8364	20.3819	19.9565	(87)
Th 2	20.1104	20.1137	20.1137	20.1198	20.1198	20.1267	20.1241	20.1241	20.1241	20.1213	20.1213	20.1153	(88)
util rest of house	0.9575	0.9270	0.8301	0.6447	0.4340	0.2351	0.1146	0.1375	0.3660	0.7139	0.9162	0.9654	(89)
MIT 2	18.9849	19.2384	19.6860	20.0031	20.1032	20.1260	20.1241	20.1240	20.1185	19.9781	19.4577	18.9236	(90)
Living area fraction										fLA = Living area / (4) =		0.4461	(91)
MIT	19.4417	19.6730	20.0880	20.3905	20.4929	20.5151	20.5147	20.5147	20.5072	20.3609	19.8699	19.3843	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4417	19.6730	20.0880	20.3905	20.4929	20.5151	20.5147	20.5147	20.5072	20.3609	19.8699	19.3843	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9504	0.9199	0.8292	0.6583	0.4566	0.2594	0.1406	0.1654	0.3960	0.7282	0.9108	0.9588	(94)
Useful gains	686.0926	764.0429	812.1727	761.8667	567.9264	331.8619	171.3683	187.5472	393.8925	597.9390	651.0122	649.9404	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1157.4972	1138.9535	1008.8283	822.1192	577.8857	332.4100	171.3891	187.5932	397.7018	671.8403	940.9551	1145.8331	(97)
Space heating kWh	350.7250	251.9400	146.3118	43.3818	7.4097	0.0000	0.0000	0.0000	0.0000	54.9826	208.7589	368.9442	(98a)
Space heating requirement - total per year (kWh/year)												1432.4540	
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	350.7250	251.9400	146.3118	43.3818	7.4097	0.0000	0.0000	0.0000	0.0000	54.9826	208.7589	368.9442	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1432.4540	
Space heating per m2											(98c) / (4) =	16.8148	(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 %) 83.7000 (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	350.7250	251.9400	146.3118	43.3818	7.4097	0.0000	0.0000	0.0000	0.0000	54.9826	208.7589	368.9442	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	419.0263	301.0035	174.8050	51.8301	8.8527	0.0000	0.0000	0.0000	0.0000	65.6901	249.4133	440.7935	(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	223.0835	196.2878	206.2385	176.1171	167.1219	146.6947	142.0599	149.9586	154.0781	176.4506	193.2569	219.9865	(64)
Efficiency of water heater												76.4000	(216)
(217)m	83.4752	82.8583	81.0652	78.5529	76.8524	76.4000	76.4000	76.4000	76.4000	79.0027	82.3283	83.6684	(217)
Fuel for water heating, kWh/month	267.2452	236.8959	254.4104	224.2020	217.4581	192.0088	185.9422	196.2809	201.6728	223.3475	234.7393	262.9266	(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	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471	(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	1711.4146 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2697.1297 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	4675.5177 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1711.4146	3.5000	59.8995	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2697.1297	3.5000	94.3995	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154	(249)
Energy for lighting	180.9734	18.3900	33.2810	(250)
Additional standing charges			94.0000	(251)
Total energy cost			297.3955	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1711.4146	0.2100	359.3971	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2697.1297	0.2100	566.3972	(264)
Space and water heating			925.7943	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	180.9734	0.1443	26.1200	(268)
Total CO2, kg/year			963.8436	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1711.4146	1.1300	1933.8985	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2697.1297	1.1300	3047.7566	(278)
Space and water heating			4981.6551	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	180.9734	1.5338	277.5830	(282)
Total Primary energy kWh/year			5389.3389	(286)

Building Regulations England Part L (BREL) Compliance Report

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

Date: Sun 02 Jul 2023 20:29:42

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/004083	Assessment Date	2023-07-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	85 m^2
Site Reference	Fortess Road	Plot Reference	Flat 1 - Heatpump
Address	Flat 1 7 Fortess Road, LONDON, NW5 1AA		

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	*11.81 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	2.94 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.71 kWh_{PE}/m^2*	
Dwelling primary energy	30.93 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*31.9 kWh/m^2*	
Dwelling fabric energy efficiency	29.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	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*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.1	Opening (1.1)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	43.25	0.15
Sheltered wall: Walls (2)	17.43	0.15
Party wall: Party Wall (1)	24.13	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Opening, WINDOWS	12.36	East	0.7	1.1 **(!)**
Opening, WINDOWS	1.98	West	0.7	1.1 **(!)**
Opening, WINDOWS	7.86	West	0.7	1.1 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
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	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	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	337.1%
Emitter type	Underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Midea
Model	MHC-V6W/D2N8-B
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 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: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Summary for Input Data

elmhurst energy

Property Reference	Fortess Road	**Issued on Date**	02/07/2023
Assessment Reference	Flat 1 - Heatpump	**Prop Type Ref**	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	88 B	**DER**	2.94	**TER**	11.81
Environmental	98 A	**% DER < TER**			75.11
CO_2 Emissions (t/year)	0.23	**DFEE**	29.43	**TFEE**	31.89
Compliance Check	See BREL	**% DFEE < TFEE**			7.70
% DPER < TPER	50.68	**DPER**	30.93	**TPER**	62.71

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

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

Orientation	East	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
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/m²K
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 m²	0.00 m
Ground floor:	1.00 m	85.19 m²	2.50 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	38.00	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	65.45	43.25	0.00	None	22.20	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	17.43	17.43	0.50	Stairwell Access Corridor 1	0.00	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	24.13	0.00	None

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	85.19

11.1 Party Floors

Summary for Input Data

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	85.19

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	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	WINDOWS	EXTERNAL	East	12.36	0
Opening	WINDOWS	EXTERNAL	West	1.98	0
Opening	WINDOWS	EXTERNAL	West	7.86	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	11.04	0.30	0.30	No
E3 Sill	Independently assessed	6.70	0.04	0.04	No
E4 Jamb	Independently assessed	47.42	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	66.30	0.07	0.07	No
E16 Corner (normal)	Independently assessed	2.50	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.50	-0.09	-0.09	No
E18 Party wall between dwellings	Independently assessed	7.50	0.06	0.06	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	19.30	0.00	0.00	No

Y-value	0.13	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP_{50}	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	11

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	105546	
Fuel Type	Electricity	
SAP Code	0	
In Winter	0.00	
In Summer	0.00	
Model Name	MHC-V6W/D2N8-B	
Manufacturer	Midea	
System Type	Heat Pump	
Controls SAP Code	2207	
Delayed Start Stat	No	

Summary for Input Data

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	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Enter value
Flow Temperature Value	35.00
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2 — None

26.0 Heat Networks — 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
Bath Count	1
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	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	2.10	kWh/day
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

None

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 1 - Heatpump	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	88 B	DER	2.94	TER	11.81
Environmental	98 A	% DER < TER			75.11
CO_2 Emissions (t/year)	0.23	DFEE	29.43	TFEE	31.89
Compliance Check	See BREL	% DFEE < TFEE			7.70
% DPER < TPER	50.68	DPER	30.93	TPER	62.71

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900	(1b)	x 2.5000	(2b) =	212.9750	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.9750	(5)

---
2. Ventilation rate
---

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2909 (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) =	0.2909 (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	0.3708	0.3636	0.3563	0.3199	0.3127	0.2763	0.2763	0.2690	0.2909	0.3127	0.3272	0.3418	(22b)
Effective ac	0.5688	0.5661	0.5635	0.5512	0.5489	0.5382	0.5382	0.5362	0.5423	0.5489	0.5535	0.5584	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1			85.1900			30.0000	2555.7000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14554.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 170.8452 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9738	39.7861	39.6021	38.7381	38.5765	37.8239	37.8239	37.6846	38.1138	38.5765	38.9035	39.2454	(38)
Heat transfer coeff	83.3343	83.1466	82.9626	82.0986	81.9370	81.1845	81.1845	81.0451	81.4743	81.9370	82.2640	82.6059	(39)

Average = Sum(39)m / 12 = 82.0979

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9782	0.9760	0.9739	0.9637	0.9618	0.9530	0.9530	0.9513	0.9564	0.9618	0.9657	0.9697	(40)
HLP (average)												0.9637	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5540 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851	(42a)
Hot water usage for baths	30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743	(42b)
Hot water usage for other uses	42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321	(42c)

Average daily hot water use (litres/day) 129.0969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)

Energy content (annual) Total = Sum(45)m = 2144.2662

Distribution loss (46)m = 0.15 x (45)m	33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)

Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(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	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(64)

Total per year (kWh/year) = Sum(64)m = 2832.0722 (64)
12Total per year (kWh/year) 2832 (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	120.6946	107.2803	115.0916	103.5873	102.1040	93.8192	93.7879	96.4115	96.2765	105.2086	109.2850	119.6668	(65)

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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	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.9810	128.4076	115.9810	119.8471	115.9810	119.8471	115.9810	115.9810	119.8471	115.9810	119.8471	115.9810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	229.9454	232.3315	226.3186	213.5177	197.3590	182.1721	172.0263	169.6402	175.6531	188.4539	204.6127	219.7996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	(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)	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)

Water heating gains (Table 5)													
	162.2240	159.6434	154.6930	143.8713	137.2366	130.3044	126.0590	129.5853	133.7173	141.4094	151.7848	160.8425	(72)
Total internal gains													
	569.4604	581.6925	558.3026	538.5461	511.8867	493.6336	475.3764	476.5165	490.5275	507.1543	537.5545	557.9331	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	702.7119	842.3607	987.5860	1164.6304	1279.1764	1279.0912	1223.1641	1118.8551	989.8019	816.4591	703.7035	667.5127	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5138	48.6233	48.7311	49.2440	49.3411	49.7985	49.7985	49.8841	49.6213	49.3411	49.1450	48.9416	
alpha	4.2343	4.2416	4.2487	4.2829	4.2894	4.3199	4.3199	4.3256	4.3081	4.2894	4.2763	4.2628	
util living area													
	0.9718	0.9430	0.8799	0.7413	0.5678	0.4012	0.2910	0.3313	0.5454	0.8279	0.9477	0.9766	(86)
Living	19.7585	20.0461	20.4144	20.7714	20.9372	20.9888	20.9978	20.9962	20.9607	20.6901	20.1626	19.7082	
Non living	18.6677	19.0267	19.4751	19.8902	20.0626	20.1156	20.1218	20.1224	20.0920	19.8147	19.1837	18.6098	
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	20.3649	20.0461	20.4144	20.7714	20.9372	20.9888	20.9978	20.9962	20.9607	20.6901	20.1626	19.8889	(87)
Th 2	20.1015	20.1034	20.1052	20.1137	20.1153	20.1227	20.1227	20.1241	20.1198	20.1153	20.1121	20.1087	(88)
util rest of house													
	0.9661	0.9323	0.8593	0.7054	0.5208	0.3481	0.2335	0.2691	0.4831	0.7918	0.9360	0.9718	(89)
MIT 2	19.5299	19.0267	19.4751	19.8902	20.0626	20.1156	20.1218	20.1224	20.0920	19.8147	19.1837	18.8799	(90)
Living area fraction										fLA = Living area / (4) =		0.4461	(91)
MIT	19.9024	19.4814	19.8941	20.2832	20.4527	20.5051	20.5125	20.5121	20.4795	20.2051	19.6204	19.3300	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9024	19.4814	19.8941	20.2832	20.4527	20.5051	20.5125	20.5121	20.4795	20.2051	19.6204	19.3300	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9646	0.9235	0.8540	0.7126	0.5391	0.3714	0.2591	0.2968	0.5090	0.7958	0.9283	0.9666	(94)
Useful gains	677.8665	777.9417	843.3584	829.9048	689.5474	475.0566	316.9419	332.0256	503.8529	649.7041	653.2186	645.2314	(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													
	1300.2127	1212.3932	1111.2078	934.5486	717.1734	479.4009	317.6372	333.2693	519.7637	787.0160	1029.9741	1249.8247	(97)
Space heating kWh													
	463.0255	291.9514	199.2800	75.3436	20.5537	0.0000	0.0000	0.0000	0.0000	102.1601	271.2640	449.8174	(98a)
Space heating requirement - total per year (kWh/year)												1873.3956	
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													
	463.0255	291.9514	199.2800	75.3436	20.5537	0.0000	0.0000	0.0000	0.0000	102.1601	271.2640	449.8174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1873.3956	
Space heating per m2											(98c) / (4) =	21.9908	(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 %)												337.1351	(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													
	463.0255	291.9514	199.2800	75.3436	20.5537	0.0000	0.0000	0.0000	0.0000	102.1601	271.2640	449.8174	(98)
Space heating efficiency (main heating system 1)													
	337.1351	337.1351	337.1351	337.1351	337.1351	0.0000	0.0000	0.0000	0.0000	337.1351	337.1351	337.1351	(210)
Space heating fuel (main heating system)													
	137.3412	86.5977	59.1098	22.3482	6.0966	0.0000	0.0000	0.0000	0.0000	30.3024	80.4615	133.4235	(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												
	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658 (64)
Efficiency of water heater												291.3989 (216)
(217)m	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989 (217)
Fuel for water heating, kWh/month												
	96.3823	85.2652	90.5994	79.6352	77.1950	69.5535	68.6120	71.3198	72.0897	80.3992	85.5157	95.3215 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471 (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	555.6810 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.3989
Water heating fuel used	971.8885 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	1708.5428 (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	555.6810	0.1571	87.3054	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	971.8885	0.1409	136.9217	(264)
Space and water heating			224.2272	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	180.9734	0.1443	26.1200	(268)
Total CO2, kg/year			250.3472	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9400	(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	555.6810	1.5816	878.8585	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	971.8885	1.5209	1478.1745	(278)
Space and water heating			2357.0330	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	180.9734	1.5338	277.5830	(282)
Total Primary energy kWh/year			2634.6160	(286)
Dwelling Primary energy Rate (DPER)			30.9300	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900	(1b)	x 2.5000	(2b) =	212.9750	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.9750	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3909	(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) =	0.3909	(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	0.4983	0.4886	0.4788	0.4299	0.4202	0.3713	0.3713	0.3615	0.3909	0.4202	0.4397	0.4593	(22b)
Effective ac	0.6242	0.6194	0.6146	0.5924	0.5883	0.5689	0.5689	0.5654	0.5764	0.5883	0.5967	0.6055	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			21.3000	1.1450	24.3893			(27)
EXTERNAL	65.4500	21.3000	44.1500	0.1800	7.9470			(29a)
HALLWAY	17.4300		17.4300	0.1800	3.1374			(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.4737			(33)
Party Wall 1			24.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 180.8452 (35)

List of Thermal Bridges

		Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	11.0400	0.0500	0.5520
E3	Sill	6.7000	0.0500	0.3350
E4	Jamb	47.4200	0.0500	2.3710
E7	Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16	Corner (normal)	2.5000	0.0900	0.2250
E17	Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18	Party wall between dwellings	7.5000	0.0600	0.4500
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3490	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 43.8227	(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	43.8682	43.5293	43.1971	41.6368	41.3449	39.9860	39.9860	39.7344	40.5094	41.3449	41.9355	42.5529	(38)
Heat transfer coeff	87.6909	87.3520	87.0198	85.4596	85.1676	83.8087	83.8087	83.5571	84.3322	85.1676	85.7582	86.3756	(39)
Average = Sum(39)m / 12 =												85.4582	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0294	1.0254	1.0215	1.0032	0.9997	0.9838	0.9838	0.9808	0.9899	0.9997	1.0067	1.0139	(40)
HLP (average)												1.0031	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5540 (42)
Hot water usage for mixer showers												
	67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851 (42a)
Hot water usage for baths												
	28.9535	28.5235	27.9179	26.8014	25.9654	25.0384	24.5377	25.1390	25.7937	26.7856	27.9251	28.8556 (42b)
Hot water usage for other uses												
	40.7855	39.3024	37.8193	36.3362	34.8531	33.3700	33.3700	34.8531	36.3362	37.8193	39.3024	40.7855 (42c)
Average daily hot water use (litres/day)												125.7326 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	136.7809	133.8603	130.3035	124.8949	120.5028	115.7809	113.9662	117.5076	121.2426	126.1998	131.6917	136.4262	(44)
Energy conte	216.6275	190.6153	200.2716	170.9749	162.2199	142.3661	137.8322	145.4989	149.5042	171.2519	187.6190	213.6104	(45)
Energy content (annual)										Total = Sum(45)m =		2088.3920	
Distribution loss (46)m = 0.15 x (45)m													
	32.4941	28.5923	30.0407	25.6462	24.3330	21.3549	20.6748	21.8248	22.4256	25.6878	28.1428	32.0416	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	267.5536	236.6130	251.1977	220.2582	213.1460	191.6494	188.7583	196.4250	198.7875	222.1780	236.9023	264.5365	(62)
WWHRS	-30.6488	-27.1060	-28.3839	-23.5030	-21.9039	-18.7433	-17.5689	-18.6828	-19.3926	-22.8617	-25.8995	-30.0812	(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													
	236.9048	209.5070	222.8139	196.7552	191.2421	172.9061	171.1894	177.7423	179.3949	199.3162	211.0027	234.4553	(64)
										Total per year (kWh/year) = Sum(64)m =		2403.2298	(64)
12Total per year (kWh/year)												2403	(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													
	112.7695	100.1778	107.3312	96.2758	94.6790	86.7634	86.5701	89.1193	89.1368	97.6821	101.8099	111.7663	(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	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	127.7001	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	115.9810	128.4076	115.9810	119.8471	115.9810	119.8471	115.9810	115.9810	119.8471	115.9810	119.8471	115.9810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.9454	232.3315	226.3186	213.5177	197.3590	182.1721	172.0263	169.6402	175.6531	188.4539	204.6127	219.7996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	35.7700	(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)													
	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)													
	151.5719	149.0741	144.2623	133.7164	127.2567	120.5047	116.3576	119.7839	123.8011	131.2932	141.4027	150.2235	(72)
Total internal gains													
	561.8084	574.1232	550.8720	531.3912	504.9068	483.8339	465.6750	466.7152	480.6113	500.0381	530.1724	550.3142	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.8600	19.6403	0.6300	0.7000	0.7700	71.1875	(76)
West	9.4400	19.6403	0.6300	0.7000	0.7700	56.6619	(80)

Solar gains	127.8494	250.1006	411.8800	600.7025	736.1834	753.6147	717.4719	616.2978	479.0335	296.7654	159.4132	105.1371	(83)
Total gains	689.6578	824.2237	962.7520	1132.0937	1241.0902	1237.4486	1183.1469	1083.0130	959.6448	796.8035	689.5856	655.4513	(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	48.8021	48.9914	49.1785	50.0763	50.2480	51.0627	51.0627	51.2165	50.7458	50.2480	49.9019	49.5453	
alpha	4.2535	4.2661	4.2786	4.3384	4.3499	4.4042	4.4042	4.4144	4.3831	4.3499	4.3268	4.3030	
util living area													

	0.9781	0.9549	0.9020	0.7741	0.6022	0.4272	0.3104	0.3525	0.5778	0.8534	0.9583	0.9818 (86)
MIT	19.6910	19.9728	20.3469	20.7371	20.9255	20.9870	20.9975	20.9957	20.9541	20.6566	20.1149	19.6567 (87)
Th 2	20.0589	20.0622	20.0655	20.0807	20.0836	20.0969	20.0969	20.0993	20.0917	20.0836	20.0778	20.0718 (88)
util rest of house												
	0.9733	0.9456	0.8830	0.7381	0.5520	0.3693	0.2473	0.2846	0.5111	0.8186	0.9480	0.9777 (89)
MIT 2	18.5477	18.9021	19.3617	19.8241	20.0217	20.0888	20.0959	20.0975	20.0598	19.7506	19.0959	18.5136 (90)
Living area fraction										fLA = Living area / (4) =		0.4461 (91)
MIT	19.0577	19.3797	19.8012	20.2314	20.4248	20.4895	20.4980	20.4981	20.4588	20.1547	19.5504	19.0235 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0577	19.3797	19.8012	20.2314	20.4248	20.4895	20.4980	20.4981	20.4588	20.1547	19.5504	19.0235 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9667	0.9374	0.8770	0.7443	0.5712	0.3947	0.2754	0.3148	0.5387	0.8215	0.9408	0.9718	(94)
Useful gains	666.6647	772.6142	844.3088	842.6538	708.8513	488.3732	325.8717	340.9724	516.9468	654.6024	648.7770	636.9859	(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	1294.1160	1264.8299	1157.4657	968.3728	743.0736	493.5898	326.6896	342.4274	536.2472	813.7548	1067.7273	1280.3885	(97)
Space heating kWh	466.8238	330.7689	232.9887	90.5177	25.4614	0.0000	0.0000	0.0000	0.0000	118.4094	301.6442	478.6915	(98a)
Space heating requirement - total per year (kWh/year)												2045.3058	
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	466.8238	330.7689	232.9887	90.5177	25.4614	0.0000	0.0000	0.0000	0.0000	118.4094	301.6442	478.6915	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2045.3058	
Space heating per m2											(98c) / (4) =	24.0088	(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													
	466.8238	330.7689	232.9887	90.5177	25.4614	0.0000	0.0000	0.0000	0.0000	118.4094	301.6442	478.6915	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	505.7679	358.3629	252.4255	98.0690	27.5855	0.0000	0.0000	0.0000	0.0000	128.2875	326.8085	518.6257	(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													
	236.9048	209.5070	222.8139	196.7552	191.2421	172.9061	171.1894	177.7423	179.3949	199.3162	211.0027	234.4553	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5518	85.0791	84.1601	82.4325	80.7617	79.8000	79.8000	79.8000	79.8000	82.9325	84.8607	85.6252	(217)
Fuel for water heating, kWh/month													
	276.9138	246.2496	264.7501	238.6865	236.7979	216.6743	214.5230	222.7347	224.8057	240.3356	248.6459	273.8159	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.0986	19.3328	17.4070	12.7531	9.8509	8.0483	8.9863	11.6807	15.1721	19.9066	22.4845	24.7683	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.7415	-28.0323	-42.7171	-51.0077	-57.6319	-54.7498	-54.0717	-49.7277	-42.5520	-33.3278	-21.1643	-16.0202	(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	-6.2055	-13.3879	-27.2476	-41.8840	-56.3412	-56.9740	-56.3156	-47.2489	-34.0608	-19.4675	-8.3857	-4.8834	(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	2215.9326	(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	2904.9328	(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)	194.4893 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-842.1458 (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	4559.2088 (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	2215.9326	0.2100	465.3458	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2904.9328	0.2100	610.0359	(264)
Space and water heating			1075.3817	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	194.4893	0.1443	28.0708	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7439	0.1334	-62.6497	
PV Unit electricity exported	-372.4019	0.1252	-46.6314	
Total			-109.2811	(269)
Total CO2, kg/year			1006.1007	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.8100	(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	2215.9326	1.1300	2504.0038	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.9328	1.1300	3282.5741	(278)
Space and water heating			5786.5779	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	194.4893	1.5338	298.3141	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-469.7439	1.4928	-701.2541	
PV Unit electricity exported	-372.4019	0.4596	-171.1569	
Total			-872.4110	(283)
Total Primary energy kWh/year			5342.5818	(286)
Target Primary Energy Rate (TPER)			62.7100	(287)

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 1 - Heatpump	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	88 B	DER	2.94	TER	11.81
Environmental	98 A	% DER < TER			75.11
CO_2 Emissions (t/year)	0.23	DFEE	29.43	TFEE	31.89
Compliance Check	See BREL	% DFEE < TFEE			7.70
% DPER < TPER	50.68	DPER	30.93	TPER	62.71

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 ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900	(1b)	x 2.5000	(2b) =	212.9750	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		212.9750	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2909 (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) =	0.2909 (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	0.3708	0.3636	0.3563	0.3199	0.3127	0.2763	0.2763	0.2690	0.2909	0.3127	0.3272	0.3418	(22b)
Effective ac	0.5688	0.5661	0.5635	0.5512	0.5489	0.5382	0.5382	0.5362	0.5423	0.5489	0.5535	0.5584	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1			85.1900			40.0000	3407.6000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15406.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 180.8452 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9738	39.7861	39.6021	38.7381	38.5765	37.8239	37.8239	37.6846	38.1138	38.5765	38.9035	39.2454	(38)
Heat transfer coeff	83.3343	83.1466	82.9626	82.0986	81.9370	81.1845	81.1845	81.0451	81.4743	81.9370	82.2640	82.6059	(39)

Average = Sum(39)m / 12 = 82.0979

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9782	0.9760	0.9739	0.9637	0.9618	0.9530	0.9530	0.9513	0.9564	0.9618	0.9657	0.9697	(40)
HLP (average)												0.9637	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5540 (42)
Hot water usage for mixer showers

67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851	(42a)

Hot water usage for baths

30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743	(42b)

Hot water usage for other uses

42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321	(42c)

Average daily hot water use (litres/day) 129.0969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)

Energy content (annual) Total = Sum(45)m = 2144.2662

Distribution loss (46)m = 0.15 x (45)m

33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(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

280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(64)

Total per year (kWh/year) = Sum(64)m = 2832.0722 (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

120.6946	107.2803	115.0916	103.5873	102.1040	93.8192	93.7879	96.4115	96.2765	105.2086	109.2850	119.6668	(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	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6187	22.7543	18.5050	14.0095	10.4723	8.8411	9.5531	12.4175	16.6668	21.1623	24.6995	26.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.2021	346.7634	337.7889	318.6832	294.5657	271.8986	256.7557	253.1943	262.1688	281.2745	305.3920	328.0591	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	(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)	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)

Water heating gains (Table 5)

	162.2240	159.6434	154.6930	143.8713	137.2366	130.3044	126.0590	129.5853	133.7173	141.4094	151.7848	160.8425	(72)
Total internal gains	635.0027	633.1191	614.9449	580.5220	546.2326	515.0022	496.3259	499.1552	516.5110	547.8042	585.8343	619.1903	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	768.2542	893.7873	1044.2283	1206.6062	1313.5223	1300.4598	1244.1135	1141.4937	1015.7853	857.1090	751.9833	728.7698	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3534	51.4693	51.5835	52.1263	52.2292	52.7133	52.7133	52.8039	52.5258	52.2292	52.0215	51.8062	
alpha	4.4236	4.4313	4.4389	4.4751	4.4819	4.5142	4.5142	4.5203	4.5017	4.4819	4.4681	4.4537	
util living area	0.9663	0.9376	0.8688	0.7303	0.5578	0.3957	0.2864	0.3252	0.5355	0.8152	0.9415	0.9722	(86)
Living	19.9107	20.1596	20.5034	20.8110	20.9505	20.9916	20.9985	20.9973	20.9693	20.7416	20.2671	19.8580	
Non living	18.8535	19.1626	19.5774	19.9318	20.0747	20.1175	20.1221	20.1229	20.0987	19.8693	19.3078	18.7931	
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	20.4427	20.1596	20.5034	20.8110	20.9505	20.9916	20.9985	20.9973	20.9693	20.7416	20.2671	20.0178	(87)
Th 2	20.1015	20.1034	20.1052	20.1137	20.1153	20.1227	20.1227	20.1241	20.1198	20.1153	20.1121	20.1087	(88)
util rest of house	0.9594	0.9256	0.8464	0.6932	0.5106	0.3429	0.2296	0.2639	0.4732	0.7769	0.9282	0.9664	(89)
MIT 2	19.6040	19.1626	19.5774	19.9318	20.0747	20.1175	20.1221	20.1229	20.0987	19.8693	19.3078	19.0301	(90)
Living area fraction									fLA = Living area / (4) =			0.4461	(91)
MIT	19.9781	19.6073	19.9905	20.3240	20.4654	20.5074	20.5130	20.5129	20.4871	20.2584	19.7357	19.4707	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9781	19.6073	19.9905	20.3240	20.4654	20.5074	20.5130	20.5129	20.4871	20.2584	19.7357	19.4707	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9583	0.9180	0.8433	0.7024	0.5296	0.3662	0.2549	0.2912	0.4997	0.7835	0.9215	0.9614	(94)
Useful gains	736.2394	820.4677	880.5605	847.4890	695.6338	476.2215	317.1759	332.4278	507.5609	671.5802	692.9822	700.6309	(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	1306.5233	1222.8601	1119.2059	937.8959	718.2081	479.5877	317.6745	333.3333	520.3817	791.3807	1039.4624	1261.4480	(97)
Space heating kWh	424.2912	270.4077	177.5521	65.0930	16.7953	0.0000	0.0000	0.0000	0.0000	89.1316	249.4657	417.2480	(98a)
Space heating requirement - total per year (kWh/year)												1709.9846	
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	424.2912	270.4077	177.5521	65.0930	16.7953	0.0000	0.0000	0.0000	0.0000	89.1316	249.4657	417.2480	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1709.9846	
Space heating per m2										(98c) / (4) =		20.0726	(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 %)	337.1351	(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	424.2912	270.4077	177.5521	65.0930	16.7953	0.0000	0.0000	0.0000	0.0000	89.1316	249.4657	417.2480	(98)
Space heating efficiency (main heating system 1)	337.1351	337.1351	337.1351	337.1351	337.1351	0.0000	0.0000	0.0000	0.0000	337.1351	337.1351	337.1351	(210)
Space heating fuel (main heating system)	125.8520	80.2075	52.6650	19.3077	4.9818	0.0000	0.0000	0.0000	0.0000	26.4379	73.9958	123.7628	(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

	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658 (64)
Efficiency of water heater												291.3989 (216)
(217)m	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989 (217)
Fuel for water heating, kWh/month												
	96.3823	85.2652	90.5994	79.6352	77.1950	69.5535	68.6120	71.3198	72.0897	80.3992	85.5157	95.3215 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471 (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	507.2105 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.3989
Water heating fuel used	971.8885 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	1660.0724 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	507.2105	16.4900	83.6390	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	971.8885	16.4900	160.2644	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	180.9734	16.4900	29.8425	(250)
Additional standing charges			0.0000	(251)
Total energy cost			273.7459	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7570 (257)
SAP value		87.7297
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	507.2105	0.1573	79.7657	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	971.8885	0.1409	136.9217	(264)
Space and water heating			216.6874	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	180.9734	0.1443	26.1200	(268)
Total CO2, kg/year			242.8074	(272)
CO2 emissions per m2			2.8500	(273)
EI value			97.5009	

EI rating 98 (274)
EI band A

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900 (1b)	x	2.5000 (2b)	=	212.9750 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9750	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2909	(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) =	0.2909	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3345	0.3199	0.3199	0.2909	0.2909	0.2545	0.2690	0.2690	0.2690	0.2836	0.2836	0.3127	(22b)
Effective ac	0.5559	0.5512	0.5512	0.5423	0.5423	0.5324	0.5362	0.5362	0.5362	0.5402	0.5402	0.5489	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1			85.1900			40.0000	3407.6000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15406.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		180.8452 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.0726	38.7381	38.7381	38.1138	38.1138	37.4170	37.6846	37.6846	37.6846	37.9670	37.9670	38.5765	(38)
Heat transfer coeff	82.4331	82.0986	82.0986	81.4743	81.4743	80.7775	81.0451	81.0451	81.0451	81.3275	81.3275	81.9370	(39)
Average = Sum(39)m / 12 =												81.5070	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9676	0.9637	0.9637	0.9564	0.9564	0.9482	0.9513	0.9513	0.9513	0.9547	0.9547	0.9618	(40)
HLP (average)												0.9568	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5540	(42)

Hot water usage for mixer showers

67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851	(42a)

Hot water usage for baths

30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743	(42b)

Hot water usage for other uses

42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321	(42c)

Average daily hot water use (litres/day)	129.0969	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)
Energy content (annual)										Total = Sum(45)m =		2144.2662	
Distribution loss (46)m = 0.15 x (45)m	33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(46)

Water storage loss:		
Store volume	200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	2.1000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	1.1340	(55)

Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(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	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(64)
										Total per year (kWh/year) = Sum(64)m =		2832.0722	(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	120.6946	107.2803	115.0916	103.5873	102.1040	93.8192	93.7879	96.4115	96.2765	105.2086	109.2850	119.6668	(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	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6187	22.7543	18.5050	14.0095	10.4723	8.8411	9.5531	12.4175	16.6668	21.1623	24.6995	26.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.2021	346.7634	337.7889	318.6832	294.5657	271.8986	256.7557	253.1943	262.1688	281.2745	305.3920	328.0591	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	(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)	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)	162.2240	159.6434	154.6930	143.8713	137.2366	130.3044	126.0590	129.5853	133.7173	141.4094	151.7848	160.8425	(72)
Total internal gains	635.0027	633.1191	614.9449	580.5220	546.2326	515.0022	496.3259	499.1552	516.5110	547.8042	585.8343	619.1903	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	781.4616	890.2000	1039.0252	1216.9401	1303.4658	1341.7925	1281.7835	1196.4826	1057.3765	880.7693	774.4064	737.4341	(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	51.9148	52.1263	52.1263	52.5258	52.5258	52.9788	52.8039	52.8039	52.8039	52.6206	52.6206	52.2292	
alpha	4.4610	4.4751	4.4751	4.5017	4.5017	4.5319	4.5203	4.5203	4.5203	4.5080	4.5080	4.4819	
util living area	0.9545	0.9250	0.8341	0.6625	0.4662	0.2763	0.1644	0.1896	0.4094	0.7303	0.9141	0.9622	(86)
Living	20.0916	20.2853	20.6346	20.8895	20.9805	20.9987	20.9999	20.9998	20.9919	20.8640	20.4517	20.0421	
Non living	19.0869	19.3259	19.7388	20.0201	20.1059	20.1261	20.1241	20.1240	20.1197	20.0042	19.5397	19.0298	
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	20.5353	20.2853	20.6346	20.8895	20.9805	20.9987	20.9999	20.9998	20.9919	20.8640	20.4517	20.1761	(87)
Th 2	20.1104	20.1137	20.1137	20.1198	20.1198	20.1267	20.1241	20.1241	20.1241	20.1213	20.1213	20.1153	(88)
util rest of house	0.9449	0.9104	0.8060	0.6196	0.4151	0.2242	0.1090	0.1303	0.3449	0.6793	0.8946	0.9540	(89)
MIT 2	19.7024	19.3259	19.7388	20.0201	20.1059	20.1261	20.1241	20.1240	20.1197	20.0042	19.5397	19.2254	(90)
Living area fraction										fLA = Living area / (4) =		0.4461	(91)
MIT	20.0739	19.7538	20.1384	20.4079	20.4960	20.5153	20.5147	20.5147	20.5088	20.3878	19.9465	19.6495	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0739	19.7538	20.1384	20.4079	20.4960	20.5153	20.5147	20.5147	20.5088	20.3878	19.9465	19.6495	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9445	0.9037	0.8068	0.6340	0.4371	0.2474	0.1337	0.1568	0.3734	0.6955	0.8902	0.9489	(94)
Useful gains	738.0753	804.4639	838.3108	771.5709	569.7649	331.9778	171.3733	187.5587	394.8284	612.5793	689.3873	699.7541	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1209.6147	1145.5915	1012.9670	823.5343	578.1412	332.4265	171.3899	187.5951	397.8324	674.0231	947.1818	1167.5600	(97)
Space heating kWh	350.8253	229.2377	129.9442	37.4137	6.2320	0.0000	0.0000	0.0000	0.0000	45.7142	185.6120	348.0476	(98a)
Space heating requirement - total per year (kWh/year)												1333.0266	
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	350.8253	229.2377	129.9442	37.4137	6.2320	0.0000	0.0000	0.0000	0.0000	45.7142	185.6120	348.0476	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.0266	
Space heating per m2										(98c) / (4) =		15.6477	(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 %)	337.0201 (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	350.8253	229.2377	129.9442	37.4137	6.2320	0.0000	0.0000	0.0000	0.0000	45.7142	185.6120	348.0476	(98)
Space heating efficiency (main heating system 1)	337.0201	337.0201	337.0201	337.0201	0.0000	0.0000	0.0000	0.0000	337.0201	337.0201	337.0201	337.0201	(210)
Space heating fuel (main heating system)	104.0963	68.0190	38.5568	11.1013	1.8491	0.0000	0.0000	0.0000	0.0000	13.5642	55.0745	103.2720	(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	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(64)
Efficiency of water heater												291.4299	(216)
(217)m	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	(217)
Fuel for water heating, kWh/month	96.3721	85.2561	90.5898	79.6267	77.1868	69.5461	68.6047	71.3122	72.0820	80.3906	85.5066	95.3114	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471	(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	395.5333 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.4299
Water heating fuel used	971.7849 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	1548.2916 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	395.5333	18.3900	72.7386 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	971.7849	18.3900	178.7112 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	180.9734	18.3900	33.2810 (250)
Additional standing charges			0.0000 (251)
Total energy cost			284.7308 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	395.5333	0.1582	62.5758 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	971.7849	0.1409	136.9071 (264)
Space and water heating			199.4829 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	180.9734	0.1443	26.1200 (268)
Total CO2, kg/year			225.6030 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	395.5333	1.5856	627.1632 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	971.7849	1.5209	1478.0170 (278)
Space and water heating			2105.1802 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	180.9734	1.5338	277.5830 (282)
Total Primary energy kWh/year			2382.7632 (286)

SAP 10 EPC IMPROVEMENTS

Flat 1 - Heatpump

Current energy efficiency rating:	B 88
Current environmental impact rating:	A 98

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£285	£285	£0
Space heating	£73	£73	£0
Water heating	£179	£179	£0
Lighting	£33	£33	£0
Total cost of fuels	£285	£285	£0
Total cost of uses	£285	£285	£0
Delivered energy	18 kWh/m²	18 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	28 kWh/m²	28 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900 (1b)	x	2.5000 (2b)	=	212.9750 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9750 (5)	

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2909 (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) =	0.2909 (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	0.3708	0.3636	0.3563	0.3199	0.3127	0.2763	0.2763	0.2690	0.2909	0.3127	0.3272	0.3418	(22b)

Effective ac	0.5688	0.5661	0.5635	0.5512	0.5489	0.5382	0.5382	0.5362	0.5423	0.5489	0.5535	0.5584 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.1900			40.0000	3407.6000	(32d)
Party Ceiling 1			85.1900			40.0000	3407.6000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15406.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		180.8452 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9738	39.7861	39.6021	38.7381	38.5765	37.8239	37.8239	37.6846	38.1138	38.5765	38.9035	39.2454	(38)
Heat transfer coeff	83.3343	83.1466	82.9626	82.0986	81.9370	81.1845	81.1845	81.0451	81.4743	81.9370	82.2640	82.6059	(39)
Average = Sum(39)m / 12 =												82.0979	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9782	0.9760	0.9739	0.9637	0.9618	0.9530	0.9530	0.9513	0.9564	0.9618	0.9657	0.9697	(40)
HLP (average)												0.9637	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5540	(42)
Hot water usage for mixer showers	67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851	(42a)
Hot water usage for baths	30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743	(42b)
Hot water usage for other uses	42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321	(42c)
Average daily hot water use (litres/day)												129.0969	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)
Energy content (annual)										Total = Sum(45)m =		2144.2662	
Distribution loss (46)m = 0.15 x (45)m	33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(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	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(64)
										Total per year (kWh/year) = Sum(64)m =		2832.0722	(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	120.6946	107.2803	115.0916	103.5873	102.1040	93.8192	93.7879	96.4115	96.2765	105.2086	109.2850	119.6668	(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	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6187	22.7543	18.5050	14.0095	10.4723	8.8411	9.5531	12.4175	16.6668	21.1623	24.6995	26.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	343.2021	346.7634	337.7889	318.6832	294.5657	271.8986	256.7557	253.1943	262.1688	281.2745	305.3920	328.0591	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	(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)													
	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)													
	162.2240	159.6434	154.6930	143.8713	137.2366	130.3044	126.0590	129.5853	133.7173	141.4094	151.7848	160.8425	(72)
Total internal gains													
	635.0027	633.1191	614.9449	580.5220	546.2326	515.0022	496.3259	499.1552	516.5110	547.8042	585.8343	619.1903	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	768.2542	893.7873	1044.2283	1206.6062	1313.5223	1300.4598	1244.1135	1141.4937	1015.7853	857.1090	751.9833	728.7698	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3534	51.4693	51.5835	52.1263	52.2292	52.7133	52.7133	52.8039	52.5258	52.2292	52.0215	51.8062	
alpha	4.4236	4.4313	4.4389	4.4751	4.4819	4.5142	4.5142	4.5203	4.5017	4.4819	4.4681	4.4537	
util living area													
	0.9663	0.9376	0.8688	0.7303	0.5578	0.3957	0.2864	0.3252	0.5355	0.8152	0.9415	0.9722	(86)
Living	19.9107	20.1596	20.5034	20.8110	20.9505	20.9916	20.9985	20.9973	20.9693	20.7416	20.2671	19.8580	
Non living	18.8535	19.1626	19.5774	19.9318	20.0747	20.1175	20.1221	20.1229	20.0987	19.8693	19.3078	18.7931	
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	20.4427	20.1596	20.5034	20.8110	20.9505	20.9916	20.9985	20.9973	20.9693	20.7416	20.2671	20.0178	(87)
Th 2	20.1015	20.1034	20.1052	20.1137	20.1153	20.1227	20.1227	20.1241	20.1198	20.1153	20.1121	20.1087	(88)
util rest of house													
	0.9594	0.9256	0.8464	0.6932	0.5106	0.3429	0.2296	0.2639	0.4732	0.7769	0.9282	0.9664	(89)
MIT 2	19.6040	19.1626	19.5774	19.9318	20.0747	20.1175	20.1221	20.1229	20.0987	19.8693	19.3078	19.0301	(90)
Living area fraction										fLA = Living area / (4) =		0.4461	(91)
MIT	19.9781	19.6073	19.9905	20.3240	20.4654	20.5074	20.5130	20.5129	20.4871	20.2584	19.7357	19.4707	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9781	19.6073	19.9905	20.3240	20.4654	20.5074	20.5130	20.5129	20.4871	20.2584	19.7357	19.4707	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9583	0.9180	0.8433	0.7024	0.5296	0.3662	0.2549	0.2912	0.4997	0.7835	0.9215	0.9614	(94)
Useful gains	736.2394	820.4677	880.5605	847.4890	695.6338	476.2215	317.1759	332.4278	507.5609	671.5802	692.9822	700.6309	(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													
	1306.5233	1222.8601	1119.2059	937.8959	718.2081	479.5877	317.6745	333.3333	520.3817	791.3807	1039.4624	1261.4480	(97)
Space heating kWh													
	424.2912	270.4077	177.5521	65.0930	16.7953	0.0000	0.0000	0.0000	0.0000	89.1316	249.4657	417.2480	(98a)
Space heating requirement - total per year (kWh/year)												1709.9846	
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													
	424.2912	270.4077	177.5521	65.0930	16.7953	0.0000	0.0000	0.0000	0.0000	89.1316	249.4657	417.2480	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1709.9846	
Space heating per m2											(98c) / (4) =	20.0726	(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 %) 337.1351 (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													
	424.2912	270.4077	177.5521	65.0930	16.7953	0.0000	0.0000	0.0000	0.0000	89.1316	249.4657	417.2480	(98)
Space heating efficiency (main heating system 1)													
	337.1351	337.1351	337.1351	337.1351	337.1351	0.0000	0.0000	0.0000	0.0000	337.1351	337.1351	337.1351	(210)
Space heating fuel (main heating system)													
	125.8520	80.2075	52.6650	19.3077	4.9818	0.0000	0.0000	0.0000	0.0000	26.4379	73.9958	123.7628	(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													
	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(64)
Efficiency of water heater												291.3989	(216)
(217)m	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	291.3989	(217)
Fuel for water heating, kWh/month													
	96.3823	85.2652	90.5994	79.6352	77.1950	69.5535	68.6120	71.3198	72.0897	80.3992	85.5157	95.3215	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471	(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 1 507.2105 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 291.3989
Water heating fuel used 971.8885 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 180.9734 (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 1660.0724 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	507.2105	16.4900	83.6390	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	971.8885	16.4900	160.2644	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	180.9734	16.4900	29.8425	(250)
Additional standing charges			0.0000	(251)
Total energy cost			273.7459	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7570 (257)
SAP value 87.7297
SAP rating (Section 12) 88 (258)

SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	507.2105	0.1573	79.7657	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	971.8885	0.1409	136.9217	(264)
Space and water heating			216.6874	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	180.9734	0.1443	26.1200	(268)
Total CO2, kg/year			242.8074	(272)
CO2 emissions per m2			2.8500	(273)
EI value			97.5009	
EI rating			98	(274)
EI band			A	

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.1900 (1b)	x	2.5000 (2b)	=	212.9750 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	212.9750	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2909	(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) =	0.2909	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3345	0.3199	0.3199	0.2909	0.2909	0.2545	0.2690	0.2690	0.2690	0.2836	0.2836	0.3127	(22b)
Effective ac	0.5559	0.5512	0.5512	0.5423	0.5423	0.5324	0.5362	0.5362	0.5362	0.5402	0.5402	0.5489	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.4500	22.2000	43.2500	0.1500	6.4875	70.0000	3027.5000	(29a)
HALLWAY	17.4300		17.4300	0.1400	2.4402	70.0000	1220.1000	(29a)
Total net area of external elements Aum(A, m2)			82.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3185			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)

Party Floor 1	85.1900	40.0000	3407.6000 (32d)
Party Ceiling 1	85.1900	40.0000	3407.6000 (32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15406.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	180.8452 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.0420 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 43.3605 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.0726	38.7381	38.7381	38.1138	38.1138	37.4170	37.6846	37.6846	37.6846	37.9670	37.9670	38.5765	(38)
Heat transfer coeff	82.4331	82.0986	82.0986	81.4743	81.4743	80.7775	81.0451	81.0451	81.0451	81.3275	81.3275	81.9370	(39)
Average = Sum(39)m / 12 =												81.5070	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9676	0.9637	0.9637	0.9564	0.9564	0.9482	0.9513	0.9513	0.9513	0.9547	0.9547	0.9618	(40)
HLP (average)												0.9568	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5540 (42)
Hot water usage for mixer showers	67.0419	66.0344	64.5663	61.7573	59.6843	57.3725	56.0585	57.5155	59.1127	61.5948	64.4642	66.7851 (42a)
Hot water usage for baths	30.4773	30.0247	29.3873	28.2120	27.3320	26.3562	25.8292	26.4621	27.1512	28.1954	29.3948	30.3743 (42b)
Hot water usage for other uses	42.9321	41.3710	39.8098	38.2486	36.6875	35.1263	35.1263	36.6875	38.2486	39.8098	41.3710	42.9321 (42c)
Average daily hot water use (litres/day)												129.0969 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.4514	137.4301	133.7634	128.2179	123.7038	118.8550	117.0139	120.6651	124.5126	129.6000	135.2300	140.0915	(44)
Energy conte	222.4407	195.6986	205.5893	175.5239	166.5290	146.1461	141.5182	149.4086	153.5365	175.8660	192.6599	219.3494	(45)
Energy content (annual)										Total = Sum(45)m =		2144.2662	
Distribution loss (46)m = 0.15 x (45)m	33.3661	29.3548	30.8384	26.3286	24.9794	21.9219	21.2277	22.4113	23.0305	26.3799	28.8990	32.9024	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(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	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658	(64)
										Total per year (kWh/year) = Sum(64)m =		2832.0722	(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	120.6946	107.2803	115.0916	103.5873	102.1040	93.8192	93.7879	96.4115	96.2765	105.2086	109.2850	119.6668	(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	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	153.2401	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6187	22.7543	18.5050	14.0095	10.4723	8.8411	9.5531	12.4175	16.6668	21.1623	24.6995	26.3307	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.2021	346.7634	337.7889	318.6832	294.5657	271.8986	256.7557	253.1943	262.1688	281.2745	305.3920	328.0591	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	52.8780	(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)													

	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	-102.1600	(71)
Water heating gains (Table 5)												
	162.2240	159.6434	154.6930	143.8713	137.2366	130.3044	126.0590	129.5853	133.7173	141.4094	151.7848	160.8425 (72)
Total internal gains												
	635.0027	633.1191	614.9449	580.5220	546.2326	515.0022	496.3259	499.1552	516.5110	547.8042	585.8343	619.1903 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439 (83)
Total gains	781.4616	890.2000	1039.0252	1216.9401	1303.4658	1341.7925	1281.7835	1196.4826	1057.3765	880.7693	774.4064	737.4341 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.9148	52.1263	52.1263	52.5258	52.5258	52.9788	52.8039	52.8039	52.8039	52.6206	52.6206	52.2292	
alpha	4.4610	4.4751	4.4751	4.5017	4.5017	4.5319	4.5203	4.5203	4.5203	4.5080	4.5080	4.4819	
util living area													
	0.9545	0.9250	0.8341	0.6625	0.4662	0.2763	0.1644	0.1896	0.4094	0.7303	0.9141	0.9622	(86)
Living	20.0916	20.2853	20.6346	20.8895	20.9805	20.9987	20.9999	20.9998	20.9919	20.8640	20.4517	20.0421	
Non living	19.0869	19.3259	19.7388	20.0201	20.1059	20.1261	20.1241	20.1240	20.1197	20.0042	19.5397	19.0298	
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	20.5353	20.2853	20.6346	20.8895	20.9805	20.9987	20.9999	20.9998	20.9919	20.8640	20.4517	20.1761	(87)
Th 2	20.1104	20.1137	20.1137	20.1198	20.1198	20.1267	20.1241	20.1241	20.1241	20.1213	20.1213	20.1153	(88)
util rest of house													
	0.9449	0.9104	0.8060	0.6196	0.4151	0.2242	0.1090	0.1303	0.3449	0.6793	0.8946	0.9540	(89)
MIT 2	19.7024	19.3259	19.7388	20.0201	20.1059	20.1261	20.1241	20.1240	20.1197	20.0042	19.5397	19.2254	(90)
Living area fraction										fLA = Living area / (4) =		0.4461	(91)
MIT	20.0739	19.7538	20.1384	20.4079	20.4960	20.5153	20.5147	20.5147	20.5088	20.3878	19.9465	19.6495	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0739	19.7538	20.1384	20.4079	20.4960	20.5153	20.5147	20.5147	20.5088	20.3878	19.9465	19.6495	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9445	0.9037	0.8068	0.6340	0.4371	0.2474	0.1337	0.1568	0.3734	0.6955	0.8902	0.9489	(94)
Useful gains	738.0753	804.4639	838.3108	771.5709	569.7649	331.9778	171.3733	187.5587	394.8284	612.5793	689.3873	699.7541	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W													
	1209.6147	1145.5915	1012.9670	823.5343	578.1412	332.4265	171.3899	187.5951	397.8324	674.0231	947.1818	1167.5600	(97)
Space heating kWh													
	350.8253	229.2377	129.9442	37.4137	6.2320	0.0000	0.0000	0.0000	0.0000	45.7142	185.6120	348.0476	(98a)
Space heating requirement - total per year (kWh/year)												1333.0266	
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													
	350.8253	229.2377	129.9442	37.4137	6.2320	0.0000	0.0000	0.0000	0.0000	45.7142	185.6120	348.0476	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1333.0266	
Space heating per m2											(98c) / (4) =	15.6477	(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 %)	337.0201	(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													
	350.8253	229.2377	129.9442	37.4137	6.2320	0.0000	0.0000	0.0000	0.0000	45.7142	185.6120	348.0476	(98)
Space heating efficiency (main heating system 1)													
	337.0201	337.0201	337.0201	337.0201	337.0201	0.0000	0.0000	0.0000	0.0000	337.0201	337.0201	337.0201	(210)
Space heating fuel (main heating system)													
	104.0963	68.0190	38.5568	11.1013	1.8491	0.0000	0.0000	0.0000	0.0000	13.5642	55.0745	103.2720	(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												
	280.8571	248.4618	264.0057	232.0559	224.9454	202.6781	199.9346	207.8250	210.0685	234.2824	249.1919	277.7658 (64)
Efficiency of water heater												291.4299 (216)
(217)m	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299	291.4299 (217)
Fuel for water heating, kWh/month												
	96.3721	85.2561	90.5898	79.6267	77.1868	69.5461	68.6047	71.3122	72.0820	80.3906	85.5066	95.3114 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.4239	17.9892	16.1973	11.8669	9.1663	7.4889	8.3618	10.8690	14.1177	18.5232	20.9220	23.0471 (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	395.5333 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.4299
Water heating fuel used	971.7849 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	180.9734 (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	1548.2916 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	395.5333	18.3900	72.7386	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	971.7849	18.3900	178.7112	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	180.9734	18.3900	33.2810	(250)
Additional standing charges			0.0000	(251)
Total energy cost			284.7308	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	395.5333	0.1582	62.5758	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	971.7849	0.1409	136.9071	(264)
Space and water heating			199.4829	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	180.9734	0.1443	26.1200	(268)
Total CO2, kg/year			225.6030	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	395.5333	1.5856	627.1632	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	971.7849	1.5209	1478.0170	(278)

Space and water heating			2105.1802 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	180.9734	1.5338	277.5830 (282)
Total Primary energy kWh/year			2382.7632 (286)

Building Regulations England Part L (BREL) Compliance Report

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

Date: Sun 02 Jul 2023 20:29:42

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/004083	Assessment Date	2023-07-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	86 m^2
Site Reference	Fortess Road	Plot Reference	Flat 2 - Boiler
Address	Flat 1 7 Fortess Road, LONDON, NW5 1AA		

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	*11.99 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	12.8 $kgCO_2/m^2$	**FAIL**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*63.66 kWh_{PE}/m^2*	
Dwelling primary energy	71.24 kWh_{PE}/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*31.8 kWh/m^2*	
Dwelling fabric energy efficiency	29.3 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	**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*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.1	Opening (1.1)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	43.78	0.15
Sheltered wall: Walls (2)	16.93	0.15
Party wall: Party Wall (1)	24.13	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Opening, WINDOWS	12.36	East	0.7	1.1 **(!)**
Opening, WINDOWS	1.98	West	0.7	1.1 **(!)**
Opening, WINDOWS	7.86	West	0.7	1.1 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
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	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	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	83.7%
Emitter type	Underfloor
Flow temperature	
System type	Combi boiler
Manufacturer	Vaillant
Model	ecoFIT sustain 835
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

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

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
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: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Summary for Input Data

elmhurst energy

Property Reference	Fortess Road	**Issued on Date**	02/07/2023
Assessment Reference	Flat 2 - Boiler	**Prop Type Ref**	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	**DER**	12.80	**TER**	11.99
Environmental	89 B	**% DER < TER**			-6.76
CO_2 Emissions (t/year)	0.97	**DFEE**	29.27	**TFEE**	31.78
Compliance Check	See BREL	**% DFEE < TFEE**			7.90
% DPER < TPER	-11.91	**DPER**	71.24	**TPER**	63.66

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

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

Orientation	East	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Mid-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/m²K
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 m²	0.00 m
Ground floor:	1.00 m	85.97 m²	2.50 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	38.00	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	65.98	43.78	0.00	None	22.20	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	16.93	16.93	0.50	Stairwell Access Corridor 1	0.00	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	24.13	0.00	None

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	85.97

11.1 Party Floors

Summary for Input Data

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	85.97

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	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	WINDOWS	EXTERNAL	East	12.36	0
Opening	WINDOWS	EXTERNAL	West	1.98	0
Opening	WINDOWS	EXTERNAL	West	7.86	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	11.04	0.30	0.30	No
E3 Sill	Independently assessed	6.70	0.04	0.04	No
E4 Jamb	Independently assessed	47.42	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	66.30	0.07	0.07	No
E16 Corner (normal)	Independently assessed	2.50	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.50	-0.09	-0.09	No
E18 Party wall between dwellings	Independently assessed	7.50	0.06	0.06	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	19.30	0.00	0.00	No

Y-value	0.13	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP_{50}	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	11

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	17960	
Fuel Type	Mains gas	
SAP Code	0	
In Winter	88.70	
In Summer	76.40	
Model Name	ecoFIT sustain 835	
Manufacturer	Vaillant	
System Type	Combi boiler	
Controls SAP Code	2110	
Delayed Start Stat	No	

Summary for Input Data

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	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Unknown
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2 None

26.0 Heat Networks 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
Bath Count	1
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 None

Cylinder Stat	No
Cylinder In Heated Space	No
Independent Time Control	No
In Airing Cupboard	No

31.0 Thermal Store None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 2 - Boiler	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	DER	12.80	TER	11.99
Environmental	89 B	% DER < TER			-6.76
CO_2 Emissions (t/year)	0.97	DFEE	29.27	TFEE	31.78
Compliance Check	See BREL	% DFEE < TFEE			7.90
% DPER < TPER	-11.91	DPER	71.24	TPER	63.66

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700	(1b)	x 2.5000	(2b) =	214.9250	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	214.9250	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

---

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			85.9700			30.0000	2579.1000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14611.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 169.9546 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.3700 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	83.6670	83.4793	83.2953	82.4310	82.2693	81.5165	81.5165	81.3771	81.8065	82.2693	82.5964	82.9384	(39)

Average = Sum(39)m / 12 = 82.4302

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9732	0.9710	0.9689	0.9588	0.9570	0.9482	0.9482	0.9466	0.9516	0.9570	0.9608	0.9647	(40)
HLP (average)												0.9588	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)
Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422
Distribution loss (46)m = 0.15 x (45)m

33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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 0.6409	0.5877	0.6477	0.5922	0.5921	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)

Total heat required for water heating calculated for each month

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)

Total per year (kWh/year) = Sum(64)m = 2157.9970 (64)
12Total per year (kWh/year) 2158 (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

74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.7476	129.2563	116.7476	120.6392	116.7476	120.6392	116.7476	116.7476	120.6392	116.7476	120.6392	116.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.4653	233.8671	227.8145	214.9291	198.6635	183.3762	173.1633	170.7615	176.8141	189.6996	205.9651	221.2524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	(69)
Pumps, fans	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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)	99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478	(72)
Total internal gains	512.6451	524.9703	501.4422	481.5809	454.7618	433.4037	415.0322	416.1703	430.2626	449.9807	480.5563	501.0445	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887 (76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	645.8966	785.6385	930.7256	1107.6651	1222.0515	1218.8613	1162.8198	1058.5089	929.5370	759.2855	646.7052	610.6241	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5091	48.6182	48.7256	49.2365	49.3333	49.7888	49.7888	49.8741	49.6123	49.3333	49.1379	48.9352	
alpha	4.2339	4.2412	4.2484	4.2824	4.2889	4.3193	4.3193	4.3249	4.3075	4.2889	4.2759	4.2623	
util living area	0.9791	0.9547	0.8983	0.7659	0.5918	0.4217	0.3071	0.3511	0.5773	0.8560	0.9606	0.9831	(86)
MIT	19.6656	19.9631	20.3507	20.7391	20.9266	20.9864	20.9973	20.9952	20.9512	20.6397	20.0778	19.6133	(87)
Th 2	20.1057	20.1075	20.1093	20.1178	20.1194	20.1267	20.1267	20.1281	20.1239	20.1194	20.1162	20.1128	(88)
util rest of house	0.9748	0.9458	0.8799	0.7313	0.5442	0.3664	0.2468	0.2857	0.5134	0.8233	0.9513	0.9795	(89)
MIT 2	18.5547	18.9283	19.4041	19.8601	20.0572	20.1180	20.1256	20.1259	20.0888	19.7640	19.0834	18.4937	(90)
Living area fraction									fLA = Living area / (4) =			0.4420	(91)
MIT	19.0457	19.3857	19.8225	20.2486	20.4415	20.5019	20.5109	20.5102	20.4700	20.1511	19.5229	18.9886	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0457	19.3857	19.8225	20.2486	20.4415	20.5019	20.5109	20.5102	20.4700	20.1511	19.5229	18.9886	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9682	0.9372	0.8732	0.7367	0.5620	0.3904	0.2734	0.3145	0.5393	0.8246	0.9437	0.9736	(94)
Useful gains	625.3305	736.3026	812.7509	815.9998	686.7387	475.8079	317.9352	332.9008	501.2569	626.0716	610.2988	594.5282	(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	1233.7307	1209.2554	1109.7031	935.4764	719.1539	481.0988	318.8010	334.4728	521.1059	785.7589	1026.0881	1226.5421	(97)
Space heating kWh	452.6497	317.8243	220.9324	86.0232	24.1169	0.0000	0.0000	0.0000	0.0000	118.8074	299.3683	470.2184	(98a)
Space heating requirement - total per year (kWh/year)												1989.9407	
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	452.6497	317.8243	220.9324	86.0232	24.1169	0.0000	0.0000	0.0000	0.0000	118.8074	299.3683	470.2184	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1989.9407	
Space heating per m2										(98c) / (4) =		23.1469	(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 %)	83.7000 (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	452.6497	317.8243	220.9324	86.0232	24.1169	0.0000	0.0000	0.0000	0.0000	118.8074	299.3683	470.2184	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	540.8002	379.7184	263.9575	102.7756	28.8135	0.0000	0.0000	0.0000	0.0000	141.9443	357.6683	561.7902	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
Efficiency of water heater												76.4000	(216)
(217)m	84.2147	83.5543	82.2932	80.0344	77.7561	76.4000	76.4000	76.4000	76.4000	80.9061	83.4213	84.3620	(217)
Fuel for water heating, kWh/month													

	265.7186	235.6499	251.3901	220.7332	215.5967	192.6037	186.5184	196.8890	202.2976	218.7685	232.3810	261.5723 (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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	2377.4679 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2680.1193 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	5325.7568 (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	2377.4679	0.2100	499.2683	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2680.1193	0.2100	562.8250	(264)
Space and water heating			1062.0933	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			1100.3153	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.8000	(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	2377.4679	1.1300	2686.5388	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2680.1193	1.1300	3028.5348	(278)
Space and water heating			5715.0735	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			6124.5921	(286)
Dwelling Primary energy Rate (DPER)			71.2400	(287)

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

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1. Overall dwelling characteristics

	Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250 (5)	

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3896	(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) =	0.3896	(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	0.4967	0.4870	0.4772	0.4285	0.4188	0.3701	0.3701	0.3604	0.3896	0.4188	0.4383	0.4578	(22b)
Effective ac	0.6234	0.6186	0.6139	0.5918	0.5877	0.5685	0.5685	0.5649	0.5759	0.5877	0.5960	0.6048	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			21.5000	1.1450	24.6183			(27)
EXTERNAL	65.9800	21.5000	44.4800	0.1800	8.0064			(29a)
HALLWAY	16.9300		16.9300	0.1800	3.0474			(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.6721			(33)
Party Wall 1			24.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 179.9546 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.0500	0.5520
E3 Sill	6.7000	0.0500	0.3350
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3490 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 44.0211 (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	44.2123	43.8726	43.5395	41.9753	41.6826	40.3202	40.3202	40.0679	40.8450	41.6826	42.2747	42.8936	(38)
Heat transfer coeff	88.2334	87.8937	87.5606	85.9964	85.7037	84.3413	84.3413	84.0890	84.8661	85.7037	86.2958	86.9148	(39)
Average = Sum(39)m / 12 =												85.9950	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0263	1.0224	1.0185	1.0003	0.9969	0.9811	0.9811	0.9781	0.9872	0.9969	1.0038	1.0110	(40)
HLP (average)												1.0003	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)

Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929 (42a)

Hot water usage for baths

29.0432	28.6119	28.0044	26.8845	26.0459	25.1160	24.6137	25.2169	25.8736	26.8686	28.0116	28.9450 (42b)

Hot water usage for other uses

	40.9130	39.4252	37.9375	36.4497	34.9620	33.4743	33.4743	34.9620	36.4497	37.9375	39.4252	40.9130 (42c)

Average daily hot water use (litres/day) 126.1240 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.2068	134.2771	130.7092	125.2837	120.8779	116.1414	114.3210	117.8734	121.6201	126.5927	132.1017	136.8509	(44)
Energy conte	217.3020	191.2087	200.8952	171.5072	162.7250	142.8093	138.2613	145.9519	149.9697	171.7851	188.2031	214.2755	(45)
Energy content (annual)										Total = Sum(45)m =		2094.8940	
Distribution loss (46)m = 0.15 x (45)m													
	32.5953	28.6813	30.1343	25.7261	24.4087	21.4214	20.7392	21.8928	22.4955	25.7678	28.2305	32.1413	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	268.2609	237.2361	251.8541	220.8222	213.6839	192.1244	189.2202	196.9109	199.2848	222.7440	237.5182	265.2344	(62)
WWHRS	-30.7442	-27.1904	-28.4722	-23.5761	-21.9721	-18.8017	-17.6236	-18.7409	-19.4529	-22.9329	-25.9802	-30.1748	(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													
	237.5167	210.0457	223.3818	197.2461	191.7118	173.3227	171.5966	178.1699	179.8318	199.8111	211.5380	235.0595	(64)
										Total per year (kWh/year) = Sum(64)m =		2409.2320	(64)
12Total per year (kWh/year)												2409	(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													
	84.9926	75.0838	79.5374	69.3549	66.8458	59.8129	58.7116	61.2687	62.1937	69.8583	74.9063	83.9863	(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	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	116.7476	129.2563	116.7476	120.6392	116.7476	120.6392	116.7476	116.7476	120.6392	116.7476	120.6392	116.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	231.4653	233.8671	227.8145	214.9291	198.6635	183.3762	173.1633	170.7615	176.8141	189.6996	205.9651	221.2524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	(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)													
	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)													
	114.2374	111.7318	106.9051	96.3263	89.8465	83.0734	78.9135	82.3505	86.3801	93.8955	104.0365	112.8848	(72)
Total internal gains													
	526.9470	539.3519	515.9639	496.3912	469.7543	448.5856	430.3212	431.3563	445.3302	464.8394	495.1376	515.3816	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.9700	19.6403	0.6300	0.7000	0.7700	71.8478	(76)
West	9.5300	19.6403	0.6300	0.7000	0.7700	57.2021	(80)

Solar gains	129.0499	252.4489	415.7474	606.3429	743.0959	760.6909	724.2088	622.0846	483.5315	299.5519	160.9100	106.1243	(83)
Total gains	655.9969	791.8009	931.7113	1102.7341	1212.8503	1209.2765	1154.5299	1053.4409	928.8617	764.3914	656.0476	621.5059	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.7051	48.8934	49.0793	49.9721	50.1427	50.9527	50.9527	51.1056	50.6376	50.1427	49.7987	49.4440	
alpha	4.2470	4.2596	4.2720	4.3315	4.3428	4.3968	4.3968	4.4070	4.3758	4.3428	4.3199	4.2963	
util living area													
	0.9819	0.9610	0.9118	0.7881	0.6165	0.4392	0.3199	0.3644	0.5967	0.8695	0.9652	0.9852	(86)
MIT	19.6320	19.9200	20.3058	20.7154	20.9180	20.9854	20.9971	20.9950	20.9478	20.6234	20.0608	19.5964	(87)
Th 2	20.0615	20.0647	20.0679	20.0831	20.0859	20.0992	20.0992	20.1016	20.0940	20.0859	20.0802	20.0742	(88)
util rest of house													
	0.9778	0.9528	0.8942	0.7530	0.5661	0.3800	0.2551	0.2945	0.5292	0.8370	0.9564	0.9819	(89)
MIT 2	18.4757	18.8392	19.3155	19.8034	20.0174	20.0900	20.0980	20.0994	20.0573	19.7167	19.0317	18.4396	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	18.9868	19.3170	19.7532	20.2065	20.4155	20.4858	20.4954	20.4953	20.4509	20.1175	19.4866	18.9509	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9868	19.3170	19.7532	20.2065	20.4155	20.4858	20.4954	20.4953	20.4509	20.1175	19.4866	18.9509	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9718	0.9447	0.8875	0.7581	0.5847	0.4056	0.2838	0.3253	0.5565	0.8382	0.9493	0.9765	(94)
Useful gains	637.4981	748.0291	826.8676	835.9420	709.1559	490.5337	327.6078	342.6865	516.8915	640.7417	622.8141	606.9211	(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	1295.8694	1267.1599	1160.4588	972.3225	746.9488	496.4185	328.5450	344.3697	538.9778	815.6858	1068.9098	1282.0705	(97)
Space heating kWh	489.8283	348.8559	248.1918	98.1940	28.1179	0.0000	0.0000	0.0000	0.0000	130.1584	321.1889	502.3111	(98a)
Space heating requirement - total per year (kWh/year)												2166.8463	
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	489.8283	348.8559	248.1918	98.1940	28.1179	0.0000	0.0000	0.0000	0.0000	130.1584	321.1889	502.3111	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2166.8463	
Space heating per m2											(98c) / (4) =	25.2047	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	489.8283	348.8559	248.1918	98.1940	28.1179	0.0000	0.0000	0.0000	0.0000	130.1584	321.1889	502.3111	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	530.1172	377.5497	268.6059	106.2705	30.4307	0.0000	0.0000	0.0000	0.0000	140.8641	347.6070	543.6267	(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	237.5167	210.0457	223.3818	197.2461	191.7118	173.3227	171.5966	178.1699	179.8318	199.8111	211.5380	235.0595	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.8959	85.4603	84.6077	82.9676	81.3060	80.3000	80.3000	80.3000	80.3000	83.4857	85.2736	85.9651	(217)
Fuel for water heating, kWh/month	276.5168	245.7818	264.0207	237.7387	235.7903	215.8440	213.6945	221.8804	223.9500	239.3357	248.0699	273.4361	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.2579	19.4606	17.5221	12.8374	9.9160	8.1015	9.0457	11.7579	15.2724	20.0382	22.6331	24.9321	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.9049	-28.2721	-43.0757	-51.4271	-58.0976	-55.1887	-54.5046	-50.1294	-42.9016	-33.6087	-21.3471	-16.1603	(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	-6.2705	-13.5272	-27.5296	-42.3151	-56.9190	-57.5581	-56.8934	-47.7351	-34.4127	-19.6699	-8.4734	-4.9347	(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	2345.0717	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2896.0589	(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)	195.7748	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-849.8565	(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	4673.0488 (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	2345.0717	0.2100	492.4651	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2896.0589	0.2100	608.1724	(264)
Space and water heating			1100.6374	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	195.7748	0.1443	28.2564	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.6177	0.1334	-63.1680	
PV Unit electricity exported	-376.2388	0.1252	-47.1123	
Total			-110.2804	(269)
Total CO2, kg/year			1030.5427	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9900	(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	2345.0717	1.1300	2649.9311	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2896.0589	1.1300	3272.5465	(278)
Space and water heating			5922.4776	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	195.7748	1.5338	300.2859	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.6177	1.4929	-707.0434	
PV Unit electricity exported	-376.2388	0.4596	-172.9222	
Total			-879.9656	(283)
Total Primary energy kWh/year			5472.8987	(286)
Target Primary Energy Rate (TPER)			63.6600	(287)

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 2 - Boiler	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	DER	12.80	TER	11.99
Environmental	89 B	% DER < TER			-6.76
CO_2 Emissions (t/year)	0.97	DFEE	29.27	TFEE	31.78
Compliance Check	See BREL	% DFEE < TFEE			7.90
% DPER < TPER	-11.91	DPER	71.24	TPER	63.66

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 ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			85.9700			40.0000	3438.8000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15470.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 179.9546 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.3700 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	83.6670	83.4793	83.2953	82.4310	82.2693	81.5165	81.5165	81.3771	81.8065	82.2693	82.5964	82.9384	(39)

Average = Sum(39)m / 12 = 82.4302

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9732	0.9710	0.9689	0.9588	0.9570	0.9482	0.9482	0.9466	0.9516	0.9570	0.9608	0.9647	(40)
HLP (average)												0.9588	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)
Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422
Distribution loss (46)m = 0.15 x (45)m

33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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 0.6409	0.5877	0.6477	0.5922	0.5921	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)

Total heat required for water heating calculated for each month

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)

Total per year (kWh/year) = Sum(64)m = 2157.9970 (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

74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)	99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478	(72)
Total internal gains	578.4881	576.6043	558.3263	523.7017	489.2022	454.7810	435.9876	438.8260	456.2853	490.7667	529.0227	562.5740	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887 (76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796 (83)
Total gains	711.7396	837.2725	987.6097	1149.7859	1256.4919	1240.2386	1183.7753	1081.1646	955.5596	800.0715	695.1716	672.1536 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3633	51.4789	51.5926	52.1335	52.2360	52.7183	52.7183	52.8087	52.5315	52.2360	52.0291	51.8146	
alpha	4.4242	4.4319	4.4395	4.4756	4.4824	4.5146	4.5146	4.5206	4.5021	4.4824	4.4686	4.4543	
util living area	0.9745	0.9499	0.8879	0.7550	0.5813	0.4157	0.3020	0.3444	0.5668	0.8439	0.9552	0.9795	(86)
MIT	19.8244	20.0827	20.4465	20.7831	20.9418	20.9897	20.9981	20.9966	20.9616	20.6974	20.1888	19.7694	(87)
Th 2	20.1057	20.1075	20.1093	20.1178	20.1194	20.1267	20.1267	20.1281	20.1239	20.1194	20.1162	20.1128	(88)
util rest of house	0.9691	0.9399	0.8676	0.7190	0.5334	0.3609	0.2425	0.2800	0.5027	0.8088	0.9445	0.9751	(89)
MIT 2	18.7494	19.0725	19.5155	19.9069	20.0712	20.1203	20.1259	20.1266	20.0971	19.8264	19.2162	18.6855	(90)
Living area fraction									fLA = Living area / (4) =			0.4420	(91)
MIT	19.2246	19.5190	19.9270	20.2942	20.4560	20.5046	20.5114	20.5111	20.4792	20.2114	19.6461	19.1646	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2246	19.5190	19.9270	20.2942	20.4560	20.5046	20.5114	20.5111	20.4792	20.2114	19.6461	19.1646	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9321	0.8630	0.7265	0.5521	0.3848	0.2688	0.3084	0.5293	0.8128	0.9377	0.9691	(94)
Useful gains	685.0227	780.4436	852.3541	835.3548	693.7002	477.1950	318.2220	333.4006	505.7317	650.2669	651.8549	651.3603	(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	1248.6922	1220.3847	1118.4078	939.2374	720.3514	481.3225	318.8468	334.5525	521.8616	790.7232	1036.2638	1241.1403	(97)
Space heating kWh	419.3701	295.6404	197.9440	74.7955	19.8285	0.0000	0.0000	0.0000	0.0000	104.4995	276.7744	438.7963	(98a)
Space heating requirement - total per year (kWh/year)												1827.6487	
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	419.3701	295.6404	197.9440	74.7955	19.8285	0.0000	0.0000	0.0000	0.0000	104.4995	276.7744	438.7963	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1827.6487	
Space heating per m2										(98c) / (4) =		21.2591	(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 %)	83.7000	(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	419.3701	295.6404	197.9440	74.7955	19.8285	0.0000	0.0000	0.0000	0.0000	104.4995	276.7744	438.7963	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	501.0395	353.2143	236.4922	89.3614	23.6899	0.0000	0.0000	0.0000	0.0000	124.8501	330.6743	524.2489	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
Efficiency of water heater												76.4000	(216)
(217)m	83.9949	83.3365	81.9571	79.6868	77.5372	76.4000	76.4000	76.4000	76.4000	80.5464	83.1837	84.1659	(217)
Fuel for water heating, kWh/month	266.4139	236.2656	252.4213	221.6961	216.2052	192.6037	186.5184	196.8890	202.2976	219.7456	233.0449	262.1818	(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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	2183.5707 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2686.2833 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	5138.0235 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2183.5707	3.6400	79.4820	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2686.2833	3.6400	97.7807	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	182.1696	16.4900	30.0398	(250)
Additional standing charges			92.0000	(251)
Total energy cost			313.4838	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8617 (257)
SAP value		86.0322
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2183.5707	0.2100	458.5499	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2686.2833	0.2100	564.1195	(264)
Space and water heating			1022.6693	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			1060.8913	(272)
CO2 emissions per m2			12.3400	(273)
EI value			89.1456	
EI rating			89	(274)
EI band			B	

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		85.9700 (1b)	x	2.5000 (2b)	=	214.9250	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2896	(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) =	0.2896	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3330	0.3185	0.3185	0.2896	0.2896	0.2534	0.2679	0.2679	0.2679	0.2823	0.2823	0.3113	(22b)
Effective ac	0.5555	0.5507	0.5507	0.5419	0.5419	0.5321	0.5359	0.5359	0.5359	0.5399	0.5399	0.5485	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			85.9700			40.0000	3438.8000	(32b)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15470.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							179.9546	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	43.3700	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3955	39.0610	39.0610	38.4365	38.4365	37.7395	38.0071	38.0071	38.0071	38.2896	38.2896	38.8993	(38)
Heat transfer coeff	82.7655	82.4310	82.4310	81.8065	81.8065	81.1095	81.3771	81.3771	81.3771	81.6596	81.6596	82.2693	(39)
Average = Sum(39)m / 12 =												81.8392	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9627	0.9588	0.9588	0.9516	0.9516	0.9435	0.9466	0.9466	0.9466	0.9499	0.9499	0.9570	(40)
HLP (average)												0.9520	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5664 (42)
Hot water usage for mixer showers												
	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929 (42a)
Hot water usage for baths												
	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684 (42b)
Hot water usage for other uses												
	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663 (42c)
Average daily hot water use (litres/day)												129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m													
	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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	0.6409	0.5877	0.6477	0.5922	0.5921	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)
Total heat required for water heating calculated for each month													
	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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													
	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
										Total per year (kWh/year) = Sum(64)m =		2157.9970	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
	74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)													
	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)													
	99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478	(72)
Total internal gains													
	578.4881	576.6043	558.3263	523.7017	489.2022	454.7810	435.9876	438.8260	456.2853	490.7667	529.0227	562.5740	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439 (83)
Total gains	724.9470	833.6852	982.4066	1160.1198	1246.4354	1281.5713	1221.4452	1136.1535	997.1508	823.7319	717.5947	680.8179 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.9228	52.1335	52.1335	52.5315	52.5315	52.9829	52.8087	52.8087	52.8087	52.6260	52.6260	52.2360	
alpha	4.4615	4.4756	4.4756	4.5021	4.5021	4.5322	4.5206	4.5206	4.5206	4.5084	4.5084	4.4824	
util living area	0.9651	0.9395	0.8565	0.6884	0.4876	0.2904	0.1732	0.2004	0.4346	0.7638	0.9326	0.9717	(86)
MIT	20.0092	20.2124	20.5865	20.8711	20.9766	20.9983	20.9999	20.9998	20.9897	20.8360	20.3818	19.9569	(87)
Th 2	20.1145	20.1178	20.1178	20.1239	20.1239	20.1307	20.1281	20.1281	20.1281	20.1253	20.1253	20.1194	(88)
util rest of house	0.9575	0.9272	0.8306	0.6457	0.4350	0.2359	0.1151	0.1381	0.3669	0.7146	0.9163	0.9654	(89)
MIT 2	18.9888	19.2416	19.6888	20.0064	20.1070	20.1300	20.1281	20.1281	20.1225	19.9815	19.4610	18.9276	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	19.4399	19.6707	20.0856	20.3886	20.4914	20.5138	20.5134	20.5134	20.5058	20.3592	19.8680	19.3826	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4399	19.6707	20.0856	20.3886	20.4914	20.5138	20.5134	20.5134	20.5058	20.3592	19.8680	19.3826	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9504	0.9199	0.8296	0.6590	0.4574	0.2599	0.1408	0.1657	0.3965	0.7285	0.9108	0.9588	(94)
Useful gains	688.9897	766.9223	814.9699	764.5637	570.0622	333.1150	171.9641	188.2091	395.3780	600.1149	653.5669	652.7635	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1162.0163	1143.3759	1012.7126	825.3114	580.1238	333.6695	171.9850	188.2555	399.2216	674.4426	944.6414	1150.3350	(97)
Space heating kWh	351.9318	252.9768	147.1206	43.7384	7.4859	0.0000	0.0000	0.0000	0.0000	55.2998	209.5737	370.1932	(98a)
Space heating requirement - total per year (kWh/year)												1438.3202	
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	351.9318	252.9768	147.1206	43.7384	7.4859	0.0000	0.0000	0.0000	0.0000	55.2998	209.5737	370.1932	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1438.3202	
Space heating per m2											(98c) / (4) =	16.7305	(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 %)	83.7000	(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	351.9318	252.9768	147.1206	43.7384	7.4859	0.0000	0.0000	0.0000	0.0000	55.2998	209.5737	370.1932	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	420.4681	302.2423	175.7713	52.2561	8.9437	0.0000	0.0000	0.0000	0.0000	66.0691	250.3867	442.2858	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
Efficiency of water heater												76.4000	(216)
(217)m	83.4762	82.8614	81.0723	78.5619	76.8556	76.4000	76.4000	76.4000	76.4000	79.0082	82.3308	83.6693	(217)
Fuel for water heating, kWh/month	268.0693	237.6204	255.1762	224.8705	218.1229	192.6037	186.5184	196.8890	202.2976	224.0238	235.4591	263.7379	(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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994	(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												1718.4232	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2705.3890 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	4691.9817 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1718.4232	3.5000	60.1448 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2705.3890	3.5000	94.6886 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154 (249)
Energy for lighting	182.1696	18.3900	33.5010 (250)
Additional standing charges			94.0000 (251)
Total energy cost			298.1498 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1718.4232	0.2100	360.8689 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2705.3890	0.2100	568.1317 (264)
Space and water heating			929.0006 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	182.1696	0.1443	26.2927 (268)
Total CO2, kg/year			967.2225 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1718.4232	1.1300	1941.8182 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2705.3890	1.1300	3057.0896 (278)
Space and water heating			4998.9078 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	182.1696	1.5338	279.4177 (282)
Total Primary energy kWh/year			5408.4263 (286)

SAP 10 EPC IMPROVEMENTS

Flat 2 - Boiler

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 89

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: B 86
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£49	£49	£0
Mains gas	£249	£249	£0
Space heating	£170	£170	£0
Water heating	£95	£95	£0
Lighting	£34	£34	£0
Total cost of fuels	£298	£298	£0
Total cost of uses	£299	£299	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)

Total net area of external elements Aum(A, m2)	82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	32.3280				(33)
Party Wall 1	24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1	85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1	85.9700			40.0000	3438.8000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15470.7000	(34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		179.9546	(35)	

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	43.3700	(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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	83.6670	83.4793	83.2953	82.4310	82.2693	81.5165	81.5165	81.3771	81.8065	82.2693	82.5964	82.9384	(39)
Average = Sum(39)m / 12 =												82.4302	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9732	0.9710	0.9689	0.9588	0.9570	0.9482	0.9482	0.9466	0.9516	0.9570	0.9608	0.9647	(40)
HLP (average)												0.9588	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.5664	(42)
Hot water usage for mixer showers	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)
Hot water usage for baths	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)
Hot water usage for other uses	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)
Average daily hot water use (litres/day)												129.4988	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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	0.6409	0.5877	0.6477	0.5922	0.5921	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)
Total heat required for water heating calculated for each month	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
										Total per year (kWh/year) = Sum(64)m =		2157.9970	(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	74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(69)
Pumps, fans	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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)

Water heating gains (Table 5)

	99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478 (72)

Total internal gains

	578.4881	576.6043	558.3263	523.7017	489.2022	454.7810	435.9876	438.8260	456.2853	490.7667	529.0227	562.5740 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887 (76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796 (83)
Total gains	711.7396	837.2725	987.6097	1149.7859	1256.4919	1240.2386	1183.7753	1081.1646	955.5596	800.0715	695.1716	672.1536 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3633	51.4789	51.5926	52.1335	52.2360	52.7183	52.7183	52.8087	52.5315	52.2360	52.0291	51.8146	
alpha	4.4242	4.4319	4.4395	4.4756	4.4824	4.5146	4.5146	4.5206	4.5021	4.4824	4.4686	4.4543	
util living area	0.9745	0.9499	0.8879	0.7550	0.5813	0.4157	0.3020	0.3444	0.5668	0.8439	0.9552	0.9795	(86)
MIT	19.8244	20.0827	20.4465	20.7831	20.9418	20.9897	20.9981	20.9966	20.9616	20.6974	20.1888	19.7694	(87)
Th 2	20.1057	20.1075	20.1093	20.1178	20.1194	20.1267	20.1267	20.1281	20.1239	20.1194	20.1162	20.1128	(88)
util rest of house	0.9691	0.9399	0.8676	0.7190	0.5334	0.3609	0.2425	0.2800	0.5027	0.8088	0.9445	0.9751	(89)
MIT 2	18.7494	19.0725	19.5155	19.9069	20.0712	20.1203	20.1259	20.1266	20.0971	19.8264	19.2162	18.6855	(90)
Living area fraction									fLA = Living area / (4) =			0.4420	(91)
MIT	19.2246	19.5190	19.9270	20.2942	20.4560	20.5046	20.5114	20.5111	20.4792	20.2114	19.6461	19.1646	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2246	19.5190	19.9270	20.2942	20.4560	20.5046	20.5114	20.5111	20.4792	20.2114	19.6461	19.1646	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9321	0.8630	0.7265	0.5521	0.3848	0.2688	0.3084	0.5293	0.8128	0.9377	0.9691	(94)
Useful gains	685.0227	780.4436	852.3541	835.3548	693.7002	477.1950	318.2220	333.4006	505.7317	650.2669	651.8549	651.3603	(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	1248.6922	1220.3847	1118.4078	939.2374	720.3514	481.3225	318.8468	334.5525	521.8616	790.7232	1036.2638	1241.1403	(97)
Space heating kWh	419.3701	295.6404	197.9440	74.7955	19.8285	0.0000	0.0000	0.0000	0.0000	104.4995	276.7744	438.7963	(98a)
Space heating requirement - total per year (kWh/year)												1827.6487	
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	419.3701	295.6404	197.9440	74.7955	19.8285	0.0000	0.0000	0.0000	0.0000	104.4995	276.7744	438.7963	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1827.6487	
Space heating per m2										(98c) / (4) =		21.2591	(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 %) 83.7000 (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	419.3701	295.6404	197.9440	74.7955	19.8285	0.0000	0.0000	0.0000	0.0000	104.4995	276.7744	438.7963	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	501.0395	353.2143	236.4922	89.3614	23.6899	0.0000	0.0000	0.0000	0.0000	124.8501	330.6743	524.2489	(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

	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676 (64)
Efficiency of water heater												76.4000 (216)
(217)m	83.9949	83.3365	81.9571	79.6868	77.5372	76.4000	76.4000	76.4000	76.4000	80.5464	83.1837	84.1659 (217)
Fuel for water heating, kWh/month												
	266.4139	236.2656	252.4213	221.6961	216.2052	192.6037	186.5184	196.8890	202.2976	219.7456	233.0449	262.1818 (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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	2183.5707 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2686.2833 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	5138.0235 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2183.5707	3.6400	79.4820	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2686.2833	3.6400	97.7807	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	182.1696	16.4900	30.0398	(250)
Additional standing charges			92.0000	(251)
Total energy cost			313.4838	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8617 (257)
SAP value		86.0322
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2183.5707	0.2100	458.5499	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2686.2833	0.2100	564.1195	(264)
Space and water heating			1022.6693	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			1060.8913	(272)
CO2 emissions per m2			12.3400	(273)
EI value			89.1456	
EI rating			89	(274)
EI band			B	

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3330	0.3185	0.3185	0.2896	0.2896	0.2534	0.2679	0.2679	0.2679	0.2823	0.2823	0.3113	(22b)
Effective ac	0.5555	0.5507	0.5507	0.5419	0.5419	0.5321	0.5359	0.5359	0.5359	0.5399	0.5399	0.5485	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			85.9700			40.0000	3438.8000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15470.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		179.9546 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.3700 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3955	39.0610	39.0610	38.4365	38.4365	37.7395	38.0071	38.0071	38.0071	38.2896	38.2896	38.8993	(38)
Heat transfer coeff													
	82.7655	82.4310	82.4310	81.8065	81.8065	81.1095	81.3771	81.3771	81.3771	81.6596	81.6596	82.2693	(39)
Average = Sum(39)m / 12 =												81.8392	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9627	0.9588	0.9588	0.9516	0.9516	0.9435	0.9466	0.9466	0.9466	0.9499	0.9499	0.9570	(40)
HLP (average)												0.9520	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5664	(42)
Hot water usage for mixer showers													
	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)
Hot water usage for baths													
	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)
Hot water usage for other uses													
	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)
Average daily hot water use (litres/day)												129.4988	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m													
	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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	0.6409	0.5877	0.6477	0.5922	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	0.6352	(61)
Total heat required for water heating calculated for each month													
	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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													
	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
									Total per year (kWh/year) = Sum(64)m =			2157.9970	(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													
	74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)													
	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)													
	99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478	(72)
Total internal gains													
	578.4881	576.6043	558.3263	523.7017	489.2022	454.7810	435.9876	438.8260	456.2853	490.7667	529.0227	562.5740	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	724.9470	833.6852	982.4066	1160.1198	1246.4354	1281.5713	1221.4452	1136.1535	997.1508	823.7319	717.5947	680.8179	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.9228	52.1335	52.1335	52.5315	52.5315	52.9829	52.8087	52.8087	52.8087	52.6260	52.6260	52.2360	
alpha	4.4615	4.4756	4.4756	4.5021	4.5021	4.5322	4.5206	4.5206	4.5206	4.5084	4.5084	4.4824	
util living area	0.9651	0.9395	0.8565	0.6884	0.4876	0.2904	0.1732	0.2004	0.4346	0.7638	0.9326	0.9717	(86)
MIT	20.0092	20.2124	20.5865	20.8711	20.9766	20.9983	20.9999	20.9998	20.9897	20.8360	20.3818	19.9569	(87)
Th 2	20.1145	20.1178	20.1178	20.1239	20.1239	20.1307	20.1281	20.1281	20.1281	20.1253	20.1253	20.1194	(88)
util rest of house	0.9575	0.9272	0.8306	0.6457	0.4350	0.2359	0.1151	0.1381	0.3669	0.7146	0.9163	0.9654	(89)
MIT 2	18.9888	19.2416	19.6888	20.0064	20.1070	20.1300	20.1281	20.1281	20.1225	19.9815	19.4610	18.9276	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	19.4399	19.6707	20.0856	20.3886	20.4914	20.5138	20.5134	20.5134	20.5058	20.3592	19.8680	19.3826	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4399	19.6707	20.0856	20.3886	20.4914	20.5138	20.5134	20.5134	20.5058	20.3592	19.8680	19.3826	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9504	0.9199	0.8296	0.6590	0.4574	0.2599	0.1408	0.1657	0.3965	0.7285	0.9108	0.9588	(94)
Useful gains	688.9897	766.9223	814.9699	764.5637	570.0622	333.1150	171.9641	188.2091	395.3780	600.1149	653.5669	652.7635	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1162.0163	1143.3759	1012.7126	825.3114	580.1238	333.6695	171.9850	188.2555	399.2216	674.4426	944.6414	1150.3350	(97)
Space heating kWh	351.9318	252.9768	147.1206	43.7384	7.4859	0.0000	0.0000	0.0000	0.0000	55.2998	209.5737	370.1932	(98a)
Space heating requirement - total per year (kWh/year)												1438.3202	
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	351.9318	252.9768	147.1206	43.7384	7.4859	0.0000	0.0000	0.0000	0.0000	55.2998	209.5737	370.1932	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1438.3202	
Space heating per m2											(98c) / (4) =	16.7305	(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 %) 83.7000 (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	351.9318	252.9768	147.1206	43.7384	7.4859	0.0000	0.0000	0.0000	0.0000	55.2998	209.5737	370.1932	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	420.4681	302.2423	175.7713	52.2561	8.9437	0.0000	0.0000	0.0000	0.0000	66.0691	250.3867	442.2858	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
Efficiency of water heater												76.4000	(216)
(217)m	83.4762	82.8614	81.0723	78.5619	76.8556	76.4000	76.4000	76.4000	76.4000	79.0082	82.3308	83.6693	(217)
Fuel for water heating, kWh/month	268.0693	237.6204	255.1762	224.8705	218.1229	192.6037	186.5184	196.8890	202.2976	224.0238	235.4591	263.7379	(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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994	(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												1718.4232 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												76.4000
Water heating fuel used												2705.3890 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												182.1696 (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												4691.9817 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1718.4232	3.5000	60.1448	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2705.3890	3.5000	94.6886	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154	(249)
Energy for lighting	182.1696	18.3900	33.5010	(250)
Additional standing charges			94.0000	(251)
Total energy cost			298.1498	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1718.4232	0.2100	360.8689	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2705.3890	0.2100	568.1317	(264)
Space and water heating			929.0006	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			967.2225	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1718.4232	1.1300	1941.8182	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2705.3890	1.1300	3057.0896	(278)
Space and water heating			4998.9078	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			5408.4263	(286)

Building Regulations England Part L (BREL) Compliance Report

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

Date: Sun 02 Jul 2023 20:29:43

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/004083	Assessment Date	2023-07-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	86 m^2
Site Reference	Fortess Road	Plot Reference	Flat 2 - Heatpump
Address	Flat 1 7 Fortess Road, LONDON, NW5 1AA		

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	*11.74 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	2.92 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.34 kWh_{PE}/m^2*	
Dwelling primary energy	30.75 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*31.8 kWh/m^2*	
Dwelling fabric energy efficiency	29.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	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*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.1	Opening (1.1)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	43.78	0.15
Sheltered wall: Walls (2)	16.93	0.15
Party wall: Party Wall (1)	24.13	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Opening, WINDOWS	12.36	East	0.7	1.1 **(!)**
Opening, WINDOWS	1.98	West	0.7	1.1 **(!)**
Opening, WINDOWS	7.86	West	0.7	1.1 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
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	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	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	337.2%
Emitter type	Underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Midea
Model	MHC-V6W/D2N8-B
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 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: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Summary for Input Data

elmhurst energy

Property Reference	Fortess Road	**Issued on Date**	02/07/2023
Assessment Reference	Flat 2 - Heatpump	**Prop Type Ref**	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	88 B	**DER**	2.92	**TER**	11.74
Environmental	98 A	**% DER < TER**			75.13
CO_2 Emissions (t/year)	0.23	**DFEE**	29.27	**TFEE**	31.78
Compliance Check	See BREL	**% DFEE < TFEE**			7.90
% DPER < TPER	50.67	**DPER**	30.75	**TPER**	62.34

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

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

Orientation	East	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Mid-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/m²K
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 m²	0.00 m
Ground floor:	1.00 m	85.97 m²	2.50 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area 38.00 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	65.98	43.78	0.00	None	22.20	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	16.93	16.93	0.50	Stairwell Access Corridor 1	0.00	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	24.13	0.00	None

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	85.97

11.1 Party Floors

Summary for Input Data

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Lowest occupied	Precast concrete planks floor, screed, carpeted	30.00	85.97

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	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	WINDOWS	EXTERNAL	East	12.36	0
Opening	WINDOWS	EXTERNAL	West	1.98	0
Opening	WINDOWS	EXTERNAL	West	7.86	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	11.04	0.30	0.30	No
E3 Sill	Independently assessed	6.70	0.04	0.04	No
E4 Jamb	Independently assessed	47.42	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	66.30	0.07	0.07	No
E16 Corner (normal)	Independently assessed	2.50	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.50	-0.09	-0.09	No
E18 Party wall between dwellings	Independently assessed	7.50	0.06	0.06	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	19.30	0.00	0.00	No

Y-value	0.13	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP_{50}	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	11

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	105546	
Fuel Type	Electricity	
SAP Code	0	
In Winter	0.00	
In Summer	0.00	
Model Name	MHC-V6W/D2N8-B	
Manufacturer	Midea	
System Type	Heat Pump	
Controls SAP Code	2207	
Delayed Start Stat	No	

Summary for Input Data

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	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Enter value
Flow Temperature Value	35.00
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2 — None

26.0 Heat Networks — 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
Bath Count	1
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	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	2.10	kWh/day
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

None

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 2 - Heatpump	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	88 B	DER	2.92	TER	11.74
Environmental	98 A	% DER < TER			75.13
CO_2 Emissions (t/year)	0.23	DFEE	29.27	TFEE	31.78
Compliance Check	See BREL	% DFEE < TFEE			7.90
% DPER < TPER	50.67	DPER	30.75	TPER	62.34

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700	(1b)	x 2.5000	(2b) =	214.9250	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.9250	(5)

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2. Ventilation rate
---

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

---
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			85.9700			30.0000	2579.1000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14611.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 169.9546 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.3700 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	83.6670	83.4793	83.2953	82.4310	82.2693	81.5165	81.5165	81.3771	81.8065	82.2693	82.5964	82.9384	(39)

Average = Sum(39)m / 12 = 82.4302

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9732	0.9710	0.9689	0.9588	0.9570	0.9482	0.9482	0.9466	0.9516	0.9570	0.9608	0.9647	(40)
HLP (average)												0.9588	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)
Hot water usage for baths	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)
Hot water usage for other uses	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422

Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)

Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)

Total per year (kWh/year) = Sum(64)m = 2838.7482 (64)
12Total per year (kWh/year) 2839 (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	120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(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	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	(66)m
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.7476	129.2563	116.7476	120.6392	116.7476	120.6392	116.7476	116.7476	120.6392	116.7476	120.6392	116.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.4653	233.8671	227.8145	214.9291	198.6635	183.3762	173.1633	170.7615	176.8141	189.6996	205.9651	221.2524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)

Water heating gains (Table 5)
162.5335 159.9448 154.9790 144.1236 137.4683 130.5145 126.2559 129.7932 133.9381 141.6541 152.0618 161.1477 (72)
Total internal gains
572.2431 584.5650 561.0378 541.1886 514.3762 496.0267 477.6636 478.7990 492.8881 509.5980 540.1628 560.6444 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796 (83)
Total gains	705.4946	845.2332	990.3212	1167.2729	1281.6659	1281.4843	1225.4513	1121.1376	992.1625	818.9028	706.3118	670.2240 (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	48.5091	48.6182	48.7256	49.2365	49.3333	49.7888	49.7888	49.8741	49.6123	49.3333	49.1379	48.9352	
alpha	4.2339	4.2412	4.2484	4.2824	4.2889	4.3193	4.3193	4.3249	4.3075	4.2889	4.2759	4.2623	
util living area	0.9718	0.9431	0.8803	0.7421	0.5688	0.4021	0.2917	0.3319	0.5462	0.8283	0.9478	0.9766	(86)
Living	19.7584	20.0453	20.4131	20.7703	20.9368	20.9887	20.9978	20.9962	20.9604	20.6893	20.1622	19.7081	
Non living	18.6710	19.0293	19.4772	19.8928	20.0662	20.1195	20.1258	20.1263	20.0958	19.8175	19.1866	18.6130	
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	20.3648	20.0453	20.4131	20.7703	20.9368	20.9887	20.9978	20.9962	20.9604	20.6893	20.1622	19.8889	(87)
Th 2	20.1057	20.1075	20.1093	20.1178	20.1194	20.1267	20.1267	20.1281	20.1239	20.1194	20.1162	20.1128	(88)
util rest of house	0.9661	0.9325	0.8598	0.7064	0.5220	0.3491	0.2343	0.2699	0.4841	0.7924	0.9361	0.9718	(89)
MIT 2	19.5338	19.0293	19.4772	19.8928	20.0662	20.1195	20.1258	20.1263	20.0958	19.8175	19.1866	18.8833	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	19.9011	19.4784	19.8909	20.2807	20.4510	20.5037	20.5112	20.5108	20.4780	20.2029	19.6178	19.3278	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9011	19.4784	19.8909	20.2807	20.4510	20.5037	20.5112	20.5108	20.4780	20.2029	19.6178	19.3278	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9646	0.9236	0.8543	0.7133	0.5399	0.3721	0.2596	0.2973	0.5097	0.7961	0.9283	0.9666	(94)
Useful gains	680.5419	780.6561	846.0239	832.6335	692.0241	476.8528	318.1254	333.2689	505.7026	651.9175	655.6488	647.8326	(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	1305.2978	1216.9917	1115.3963	938.1221	719.9388	481.2491	318.8291	334.5268	521.7594	790.0217	1033.9278	1254.6733	(97)
Space heating kWh	464.8184	293.2176	200.4131	75.9518	20.7685	0.0000	0.0000	0.0000	0.0000	102.7496	272.3609	451.4895	(98a)
Space heating requirement - total per year (kWh/year)												1881.7693	
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	464.8184	293.2176	200.4131	75.9518	20.7685	0.0000	0.0000	0.0000	0.0000	102.7496	272.3609	451.4895	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1881.7693	
Space heating per m2											(98c) / (4) =	21.8887	(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 %) 337.1991 (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	464.8184	293.2176	200.4131	75.9518	20.7685	0.0000	0.0000	0.0000	0.0000	102.7496	272.3609	451.4895	(98)
Space heating efficiency (main heating system 1)	337.1991	337.1991	337.1991	337.1991	337.1991	0.0000	0.0000	0.0000	0.0000	337.1991	337.1991	337.1991	(210)
Space heating fuel (main heating system)	137.8469	86.9568	59.4346	22.5243	6.1591	0.0000	0.0000	0.0000	0.0000	30.4715	80.7715	133.8940	(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												
	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488 (64)
Efficiency of water heater												291.3816 (216)
(217)m	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816 (217)
Fuel for water heating, kWh/month												
	96.6257	85.4793	90.8245	79.8274	77.3775	69.7138	68.7673	71.4836	72.2580	80.5919	85.7267	95.5615 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	558.0588 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.3816
Water heating fuel used	974.2373 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	1714.4656 (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	558.0588	0.1571	87.6750	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.2373	0.1409	137.2542	(264)
Space and water heating			224.9292	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			251.2219	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9200	(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	558.0588	1.5816	882.6044	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.2373	1.5209	1481.7528	(278)
Space and water heating			2364.3572	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			2643.7749	(286)
Dwelling Primary energy Rate (DPER)			30.7500	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3896	(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) =	0.3896	(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	0.4967	0.4870	0.4772	0.4285	0.4188	0.3701	0.3701	0.3604	0.3896	0.4188	0.4383	0.4578	(22b)
Effective ac	0.6234	0.6186	0.6139	0.5918	0.5877	0.5685	0.5685	0.5649	0.5759	0.5877	0.5960	0.6048	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			21.5000	1.1450	24.6183			(27)
EXTERNAL	65.9800	21.5000	44.4800	0.1800	8.0064			(29a)
HALLWAY	16.9300		16.9300	0.1800	3.0474			(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.6721			(33)
Party Wall 1			24.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 179.9546 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.0500	0.5520
E3 Sill	6.7000	0.0500	0.3350
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3490 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 44.0211 (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	44.2123	43.8726	43.5395	41.9753	41.6826	40.3202	40.3202	40.0679	40.8450	41.6826	42.2747	42.8936	(38)
Heat transfer coeff	88.2334	87.8937	87.5606	85.9964	85.7037	84.3413	84.3413	84.0890	84.8661	85.7037	86.2958	86.9148	(39)
Average = Sum(39)m / 12 =												85.9950	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0263	1.0224	1.0185	1.0003	0.9969	0.9811	0.9811	0.9781	0.9872	0.9969	1.0038	1.0110	(40)
HLP (average)												1.0003	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)

Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929 (42a)

Hot water usage for baths

29.0432	28.6119	28.0044	26.8845	26.0459	25.1160	24.6137	25.2169	25.8736	26.8686	28.0116	28.9450 (42b)

Hot water usage for other uses

40.9130	39.4252	37.9375	36.4497	34.9620	33.4743	33.4743	34.9620	36.4497	37.9375	39.4252	40.9130 (42c)

Average daily hot water use (litres/day) 126.1240 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.2068	134.2771	130.7092	125.2837	120.8779	116.1414	114.3210	117.8734	121.6201	126.5927	132.1017	136.8509	(44)
Energy conte	217.3020	191.2087	200.8952	171.5072	162.7250	142.8093	138.2613	145.9519	149.9697	171.7851	188.2031	214.2755	(45)
Energy content (annual)										Total = Sum(45)m =		2094.8940	
Distribution loss (46)m = 0.15 x (45)m	32.5953	28.6813	30.1343	25.7261	24.4087	21.4214	20.7392	21.8928	22.4955	25.7678	28.2305	32.1413	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	268.2281	237.2065	251.8212	220.7905	213.6510	192.0926	189.1874	196.8780	199.2530	222.7111	237.4864	265.2015	(62)
WWHRS	-30.7442	-27.1904	-28.4722	-23.5761	-21.9721	-18.8017	-17.6236	-18.7409	-19.4529	-22.9329	-25.9802	-30.1748	(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	237.4839	210.0161	223.3490	197.2143	191.6789	173.2910	171.5638	178.1371	179.8001	199.7783	211.5063	235.0267	(64)
										Total per year (kWh/year) = Sum(64)m =		2408.8455	(64)
12Total per year (kWh/year)												2409	(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	112.9938	100.3751	107.5385	96.4528	94.8469	86.9107	86.7127	89.2699	89.2916	97.8594	102.0042	111.9875	(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	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.7476	129.2563	116.7476	120.6392	116.7476	120.6392	116.7476	116.7476	120.6392	116.7476	120.6392	116.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.4653	233.8671	227.8145	214.9291	198.6635	183.3762	173.1633	170.7615	176.8141	189.6996	205.9651	221.2524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)	151.8733	149.3677	144.5410	133.9622	127.4824	120.7094	116.5494	119.9864	124.0161	131.5314	141.6725	150.5208	(72)
Total internal gains	564.5830	576.9879	553.5998	534.0272	507.3903	486.2215	467.9571	468.9922	482.9661	502.4753	532.7735	553.0175	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.9700	19.6403	0.6300	0.7000	0.7700	71.8478	(76)
West	9.5300	19.6403	0.6300	0.7000	0.7700	57.2021	(80)

Solar gains	129.0499	252.4489	415.7474	606.3429	743.0959	760.6909	724.2088	622.0846	483.5315	299.5519	160.9100	106.1243	(83)
Total gains	693.6328	829.4368	969.3473	1140.3700	1250.4862	1246.9124	1192.1659	1091.0768	966.4976	802.0273	693.6835	659.1419	(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	48.7051	48.8934	49.0793	49.9721	50.1427	50.9527	50.9527	51.1056	50.6376	50.1427	49.7987	49.4440
alpha	4.2470	4.2596	4.2720	4.3315	4.3428	4.3968	4.3968	4.4070	4.3758	4.3428	4.3199	4.2963
util living area												

	0.9780	0.9548	0.9016	0.7735	0.6015	0.4266	0.3100	0.3521	0.5773	0.8531	0.9581	0.9817 (86)
MIT	19.6885	19.9711	20.3462	20.7369	20.9254	20.9870	20.9975	20.9957	20.9540	20.6559	20.1130	19.6540 (87)
Th 2	20.0615	20.0647	20.0679	20.0831	20.0859	20.0992	20.0992	20.1016	20.0940	20.0859	20.0802	20.0742 (88)
util rest of house												
	0.9732	0.9454	0.8827	0.7375	0.5515	0.3689	0.2471	0.2845	0.5108	0.8183	0.9479	0.9777 (89)
MIT 2	18.5468	18.9023	19.3631	19.8261	20.0239	20.0911	20.0981	20.0997	20.0620	19.7519	19.0957	18.5122 (90)
Living area fraction										fLA = Living area / (4) =		0.4420 (91)
MIT	19.0514	19.3747	19.7976	20.2287	20.4224	20.4871	20.4957	20.4957	20.4563	20.1515	19.5454	19.0169 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0514	19.3747	19.7976	20.2287	20.4224	20.4871	20.4957	20.4957	20.4563	20.1515	19.5454	19.0169 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9665	0.9371	0.8765	0.7435	0.5703	0.3940	0.2749	0.3143	0.5380	0.8211	0.9406	0.9717	(94)
Useful gains	670.4090	777.2650	849.5855	847.9035	713.1507	491.2739	327.7402	342.9402	520.0094	658.5047	652.4848	640.4962	(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	1301.5705	1272.2367	1164.3466	974.2233	747.5392	496.5236	328.5644	344.4065	539.4318	818.5997	1073.9837	1287.8070	(97)
Space heating kWh	469.5842	332.6210	234.1823	90.9503	25.5851	0.0000	0.0000	0.0000	0.0000	119.1107	303.4792	481.5992	(98a)
Space heating requirement - total per year (kWh/year)												2057.1119	
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	469.5842	332.6210	234.1823	90.9503	25.5851	0.0000	0.0000	0.0000	0.0000	119.1107	303.4792	481.5992	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2057.1119	
Space heating per m2											(98c) / (4) =	23.9283	(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													
	469.5842	332.6210	234.1823	90.9503	25.5851	0.0000	0.0000	0.0000	0.0000	119.1107	303.4792	481.5992	(98)
Space heating efficiency (main heating system 1)													
	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)													
	508.7586	360.3694	253.7186	98.5377	27.7195	0.0000	0.0000	0.0000	0.0000	129.0474	328.7966	521.7759	(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													
	237.4839	210.0161	223.3490	197.2143	191.6789	173.2910	171.5638	178.1371	179.8001	199.7783	211.5063	235.0267	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5590	85.0860	84.1662	82.4370	80.7639	79.8000	79.8000	79.8000	79.8000	82.9398	84.8689	85.6326	(217)
Fuel for water heating, kWh/month													
	277.5674	246.8280	265.3667	239.2303	237.3323	217.1566	214.9922	223.2295	225.3133	240.8714	249.2153	274.4594	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.2579	19.4606	17.5221	12.8374	9.9160	8.1015	9.0457	11.7579	15.2724	20.0382	22.6331	24.9321	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.9049	-28.2721	-43.0757	-51.4271	-58.0976	-55.1887	-54.5046	-50.1294	-42.9016	-33.6087	-21.3471	-16.1603	(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	-6.2705	-13.5272	-27.5296	-42.3151	-56.9190	-57.5581	-56.8934	-47.7351	-34.4127	-19.6699	-8.4734	-4.9347	(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	2228.7236	(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	2911.5625	(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)	195.7748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-849.8565 (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	4572.2044 (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	2228.7236	0.2100	468.0320	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2911.5625	0.2100	611.4281	(264)
Space and water heating			1079.4601	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	195.7748	0.1443	28.2564	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.6177	0.1334	-63.1680	
PV Unit electricity exported	-376.2388	0.1252	-47.1123	
Total			-110.2804	(269)
Total CO2, kg/year			1009.3653	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.7400	(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	2228.7236	1.1300	2518.4576	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2911.5625	1.1300	3290.0656	(278)
Space and water heating			5808.5233	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	195.7748	1.5338	300.2859	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.6177	1.4929	-707.0434	
PV Unit electricity exported	-376.2388	0.4596	-172.9222	
Total			-879.9656	(283)
Total Primary energy kWh/year			5358.9444	(286)
Target Primary Energy Rate (TPER)			62.3400	(287)

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 2 - Heatpump	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	88 B	DER	2.92	TER	11.74
Environmental	98 A	% DER < TER			75.13
CO_2 Emissions (t/year)	0.23	DFEE	29.27	TFEE	31.78
Compliance Check	See BREL	% DFEE < TFEE			7.90
% DPER < TPER	50.67	DPER	30.75	TPER	62.34

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 ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			85.9700			40.0000	3438.8000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15470.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 179.9546 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0420 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.3700 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	83.6670	83.4793	83.2953	82.4310	82.2693	81.5165	81.5165	81.3771	81.8065	82.2693	82.5964	82.9384	(39)

Average = Sum(39)m / 12 = 82.4302

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9732	0.9710	0.9689	0.9588	0.9570	0.9482	0.9482	0.9466	0.9516	0.9570	0.9608	0.9647	(40)
HLP (average)												0.9588	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)
Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422

Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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

281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)

Total per year (kWh/year) = Sum(64)m = 2838.7482 (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

120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)													

	162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477	(72)
Total internal gains	638.0861	636.1990	617.9220	583.3094	548.8165	517.4040	498.6190	501.4547	518.9108	550.3840	588.6292	622.1739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	771.3376	896.8672	1047.2054	1209.3936	1316.1063	1302.8616	1246.4067	1143.7933	1018.1851	859.6888	754.7782	731.7535	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3633	51.4789	51.5926	52.1335	52.2360	52.7183	52.7183	52.8087	52.5315	52.2360	52.0291	51.8146	
alpha	4.4242	4.4319	4.4395	4.4756	4.4824	4.5146	4.5146	4.5206	4.5021	4.4824	4.4686	4.4543	
util living area	0.9663	0.9377	0.8693	0.7311	0.5588	0.3966	0.2870	0.3259	0.5363	0.8156	0.9415	0.9722	(86)
Living	19.9109	20.1591	20.5024	20.8102	20.9502	20.9915	20.9984	20.9973	20.9691	20.7410	20.2669	19.8583	
Non living	18.8572	19.1655	19.5800	19.9348	20.0784	20.1214	20.1261	20.1269	20.1026	19.8725	19.3110	18.7968	
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	20.4428	20.1591	20.5024	20.8102	20.9502	20.9915	20.9984	20.9973	20.9691	20.7410	20.2669	20.0180	(87)
Th 2	20.1057	20.1075	20.1093	20.1178	20.1194	20.1267	20.1267	20.1281	20.1239	20.1194	20.1162	20.1128	(88)
util rest of house	0.9594	0.9258	0.8470	0.6943	0.5118	0.3439	0.2304	0.2648	0.4743	0.7776	0.9283	0.9664	(89)
MIT 2	19.6080	19.1655	19.5800	19.9348	20.0784	20.1214	20.1261	20.1269	20.1026	19.8725	19.3110	19.0339	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	19.9770	19.6047	19.9877	20.3218	20.4638	20.5060	20.5117	20.5116	20.4856	20.2564	19.7335	19.4689	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9770	19.6047	19.9877	20.3218	20.4638	20.5060	20.5117	20.5116	20.4856	20.2564	19.7335	19.4689	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9583	0.9181	0.8436	0.7031	0.5305	0.3669	0.2554	0.2917	0.5004	0.7839	0.9216	0.9614	(94)
Useful gains	739.1964	823.3940	883.4645	850.3716	698.1821	478.0338	318.3627	333.6766	509.4493	673.9309	695.5960	703.4907	(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	1311.6469	1227.5368	1123.4635	941.5061	720.9875	481.4387	318.8670	334.5917	522.3848	794.4233	1043.4832	1266.3768	(97)
Space heating kWh	425.9032	271.5840	178.5592	65.6169	16.9672	0.0000	0.0000	0.0000	0.0000	89.6464	250.4788	418.7873	(98a)
Space heating requirement - total per year (kWh/year)												1717.5429	
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	425.9032	271.5840	178.5592	65.6169	16.9672	0.0000	0.0000	0.0000	0.0000	89.6464	250.4788	418.7873	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1717.5429	
Space heating per m2											(98c) / (4) =	19.9784	(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 %)	337.1991	(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	425.9032	271.5840	178.5592	65.6169	16.9672	0.0000	0.0000	0.0000	0.0000	89.6464	250.4788	418.7873	(98)
Space heating efficiency (main heating system 1)	337.1991	337.1991	337.1991	337.1991	337.1991	0.0000	0.0000	0.0000	0.0000	337.1991	337.1991	337.1991	(210)
Space heating fuel (main heating system)	126.3061	80.5411	52.9536	19.4594	5.0318	0.0000	0.0000	0.0000	0.0000	26.5856	74.2822	124.1959	(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												
	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488 (64)
Efficiency of water heater												291.3816 (216)
(217)m	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816 (217)
Fuel for water heating, kWh/month												
	96.6257	85.4793	90.8245	79.8274	77.3775	69.7138	68.7673	71.4836	72.2580	80.5919	85.7267	95.5615 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	509.3557 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.3816
Water heating fuel used	974.2373 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	1665.7625 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	509.3557	16.4900	83.9928	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.2373	16.4900	160.6517	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	182.1696	16.4900	30.0398	(250)
Additional standing charges			0.0000	(251)
Total energy cost			274.6842	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7550	(257)
SAP value		87.7610	
SAP rating (Section 12)		88	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	509.3557	0.1573	80.0995	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.2373	0.1409	137.2542	(264)
Space and water heating			217.3537	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			243.6464	(272)
CO2 emissions per m2			2.8300	(273)
EI value			97.5072	

EI rating 98 (274)
EI band A

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

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2. Ventilation rate
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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1396	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2896	(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) =	0.2896	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3330	0.3185	0.3185	0.2896	0.2896	0.2534	0.2679	0.2679	0.2679	0.2823	0.2823	0.3113	(22b)
Effective ac	0.5555	0.5507	0.5507	0.5419	0.5419	0.5321	0.5359	0.5359	0.5359	0.5399	0.5399	0.5485	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			85.9700			40.0000	3438.8000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15470.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		179.9546 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.3700 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3955	39.0610	39.0610	38.4365	38.4365	37.7395	38.0071	38.0071	38.0071	38.2896	38.2896	38.8993	(38)
Heat transfer coeff	82.7655	82.4310	82.4310	81.8065	81.8065	81.1095	81.3771	81.3771	81.3771	81.6596	81.6596	82.2693	(39)
Average = Sum(39)m / 12 =												81.8392	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9627	0.9588	0.9588	0.9516	0.9516	0.9435	0.9466	0.9466	0.9466	0.9499	0.9499	0.9570	(40)
HLP (average)												0.9520	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5664 (42)
Hot water usage for mixer showers	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929 (42a)
Hot water usage for baths	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684 (42b)
Hot water usage for other uses	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663 (42c)
Average daily hot water use (litres/day)												129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
									Total per year (kWh/year) = Sum(64)m =			2838.7482	(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	120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(65)

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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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)	162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477	(72)
Total internal gains	638.0861	636.1990	617.9220	583.3094	548.8165	517.4040	498.6190	501.4547	518.9108	550.3840	588.6292	622.1739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	784.5450	893.2799	1042.0023	1219.7275	1306.0498	1344.1943	1284.0766	1198.7822	1059.7763	883.3491	777.2013	740.4178	(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	51.9228	52.1335	52.1335	52.5315	52.5315	52.9829	52.8087	52.8087	52.8087	52.6260	52.6260	52.2360	
alpha	4.4615	4.4756	4.4756	4.5021	4.5021	4.5322	4.5206	4.5206	4.5206	4.5084	4.5084	4.4824	
util living area	0.9545	0.9251	0.8346	0.6634	0.4671	0.2770	0.1647	0.1900	0.4101	0.7309	0.9142	0.9622	(86)
Living	20.0916	20.2848	20.6338	20.8889	20.9803	20.9986	20.9999	20.9998	20.9919	20.8636	20.4513	20.0422	
Non living	19.0904	19.3288	19.7416	20.0235	20.1098	20.1301	20.1281	20.1281	20.1237	20.0077	19.5428	19.0334	
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	20.5353	20.2848	20.6338	20.8889	20.9803	20.9986	20.9999	20.9998	20.9919	20.8636	20.4513	20.1762	(87)
Th 2	20.1145	20.1178	20.1178	20.1239	20.1239	20.1307	20.1281	20.1281	20.1281	20.1253	20.1253	20.1194	(88)
util rest of house	0.9450	0.9107	0.8066	0.6207	0.4161	0.2249	0.1095	0.1309	0.3458	0.6801	0.8949	0.9541	(89)
MIT 2	19.7062	19.3288	19.7416	20.0235	20.1098	20.1301	20.1281	20.1281	20.1237	20.0077	19.5428	19.2291	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	20.0727	19.7513	20.1359	20.4060	20.4946	20.5140	20.5134	20.5134	20.5074	20.3860	19.9444	19.6477	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0727	19.7513	20.1359	20.4060	20.4946	20.5140	20.5134	20.5134	20.5074	20.3860	19.9444	19.6477	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9445	0.9038	0.8073	0.6348	0.4379	0.2479	0.1339	0.1570	0.3740	0.6960	0.8903	0.9489	(94)
Useful gains	740.9993	807.3601	841.1575	774.3181	571.9155	333.2321	171.9691	188.2207	396.3201	614.7917	691.9523	702.5798	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1214.3937	1150.0230	1016.8638	826.7355	580.3816	333.6861	171.9859	188.2575	399.3532	676.6332	950.8761	1172.1487	(97)
Space heating kWh	352.2054	230.2695	130.7255	37.7405	6.2988	0.0000	0.0000	0.0000	0.0000	46.0101	186.4251	349.3593	(98a)
Space heating requirement - total per year (kWh/year)												1339.0343	
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	352.2054	230.2695	130.7255	37.7405	6.2988	0.0000	0.0000	0.0000	0.0000	46.0101	186.4251	349.3593	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1339.0343	
Space heating per m2										(98c) / (4) =		15.5756	(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 %)	337.0850 (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	352.2054	230.2695	130.7255	37.7405	6.2988	0.0000	0.0000	0.0000	0.0000	46.0101	186.4251	349.3593	(98)
Space heating efficiency (main heating system 1)	337.0850	337.0850	337.0850	337.0850	0.0000	0.0000	0.0000	0.0000	337.0850	337.0850	337.0850		(210)
Space heating fuel (main heating system)	104.4857	68.3120	38.7812	11.1961	1.8686	0.0000	0.0000	0.0000	0.0000	13.6494	55.3051	103.6413	(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	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
Efficiency of water heater												291.4124	(216)
(217)m	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	(217)
Fuel for water heating, kWh/month	96.6155	85.4703	90.8149	79.8190	77.3694	69.7064	68.7600	71.4761	72.2503	80.5834	85.7176	95.5514	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994	(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	397.2394 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.4124
Water heating fuel used	974.1343 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	1553.5432 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	397.2394	18.3900	73.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.1343	18.3900	179.1433	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	182.1696	18.3900	33.5010	(250)
Additional standing charges			0.0000	(251)
Total energy cost			285.6966	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	397.2394	0.1582	62.8432	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.1343	0.1409	137.2397	(264)
Space and water heating			200.0829	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			226.3756	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	397.2394	1.5856	629.8594	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.1343	1.5209	1481.5961	(278)
Space and water heating			2111.4555	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			2390.8732	(286)

SAP 10 EPC IMPROVEMENTS

Flat 2 - Heatpump

Current energy efficiency rating:	B 88
Current environmental impact rating:	A 98

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£286	£286	£0
Space heating	£73	£73	£0
Water heating	£179	£179	£0
Lighting	£34	£34	£0
Total cost of fuels	£286	£286	£0
Total cost of uses	£286	£286	£0
Delivered energy	18 kWh/m²	18 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	28 kWh/m²	28 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)

Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			85.9700			40.0000	3438.8000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15470.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		179.9546 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.0420 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.3700 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	83.6670	83.4793	83.2953	82.4310	82.2693	81.5165	81.5165	81.3771	81.8065	82.2693	82.5964	82.9384	(39)
Average = Sum(39)m / 12 =												82.4302	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9732	0.9710	0.9689	0.9588	0.9570	0.9482	0.9482	0.9466	0.9516	0.9570	0.9608	0.9647	(40)
HLP (average)												0.9588	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5664 (42)
Hot water usage for mixer showers	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929 (42a)
Hot water usage for baths	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684 (42b)
Hot water usage for other uses	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663 (42c)
Average daily hot water use (litres/day)												129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
										Total per year (kWh/year) = Sum(64)m =		2838.7482	(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	120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)

	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)

Water heating gains (Table 5)

	162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477	(72)

Total internal gains

	638.0861	636.1990	617.9220	583.3094	548.8165	517.4040	498.6190	501.4547	518.9108	550.3840	588.6292	622.1739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	771.3376	896.8672	1047.2054	1209.3936	1316.1063	1302.8616	1246.4067	1143.7933	1018.1851	859.6888	754.7782	731.7535	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3633	51.4789	51.5926	52.1335	52.2360	52.7183	52.7183	52.8087	52.5315	52.2360	52.0291	51.8146	
alpha	4.4242	4.4319	4.4395	4.4756	4.4824	4.5146	4.5146	4.5206	4.5021	4.4824	4.4686	4.4543	
util living area													
	0.9663	0.9377	0.8693	0.7311	0.5588	0.3966	0.2870	0.3259	0.5363	0.8156	0.9415	0.9722	(86)
Living	19.9109	20.1591	20.5024	20.8102	20.9502	20.9915	20.9984	20.9973	20.9691	20.7410	20.2669	19.8583	
Non living	18.8572	19.1655	19.5800	19.9348	20.0784	20.1214	20.1261	20.1269	20.1026	19.8725	19.3110	18.7968	
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	20.4428	20.1591	20.5024	20.8102	20.9502	20.9915	20.9984	20.9973	20.9691	20.7410	20.2669	20.0180	(87)
Th 2	20.1057	20.1075	20.1093	20.1178	20.1194	20.1267	20.1267	20.1281	20.1239	20.1194	20.1162	20.1128	(88)
util rest of house													
	0.9594	0.9258	0.8470	0.6943	0.5118	0.3439	0.2304	0.2648	0.4743	0.7776	0.9283	0.9664	(89)
MIT 2	19.6080	19.1655	19.5800	19.9348	20.0784	20.1214	20.1261	20.1269	20.1026	19.8725	19.3110	19.0339	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	19.9770	19.6047	19.9877	20.3218	20.4638	20.5060	20.5117	20.5116	20.4856	20.2564	19.7335	19.4689	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9770	19.6047	19.9877	20.3218	20.4638	20.5060	20.5117	20.5116	20.4856	20.2564	19.7335	19.4689	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9583	0.9181	0.8436	0.7031	0.5305	0.3669	0.2554	0.2917	0.5004	0.7839	0.9216	0.9614	(94)
Useful gains	739.1964	823.3940	883.4645	850.3716	698.1821	478.0338	318.3627	333.6766	509.4493	673.9309	695.5960	703.4907	(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													
	1311.6469	1227.5368	1123.4635	941.5061	720.9875	481.4387	318.8670	334.5917	522.3848	794.4233	1043.4832	1266.3768	(97)
Space heating kWh													
	425.9032	271.5840	178.5592	65.6169	16.9672	0.0000	0.0000	0.0000	0.0000	89.6464	250.4788	418.7873	(98a)
Space heating requirement - total per year (kWh/year)												1717.5429	
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													
	425.9032	271.5840	178.5592	65.6169	16.9672	0.0000	0.0000	0.0000	0.0000	89.6464	250.4788	418.7873	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1717.5429	
Space heating per m2											(98c) / (4) =	19.9784	(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 %) 337.1991 (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													
	425.9032	271.5840	178.5592	65.6169	16.9672	0.0000	0.0000	0.0000	0.0000	89.6464	250.4788	418.7873	(98)
Space heating efficiency (main heating system 1)													
	337.1991	337.1991	337.1991	337.1991	337.1991	0.0000	0.0000	0.0000	0.0000	337.1991	337.1991	337.1991	(210)
Space heating fuel (main heating system)													
	126.3061	80.5411	52.9536	19.4594	5.0318	0.0000	0.0000	0.0000	0.0000	26.5856	74.2822	124.1959	(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													
	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
Efficiency of water heater												291.3816	(216)
(217)m	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	291.3816	(217)
Fuel for water heating, kWh/month													
	96.6257	85.4793	90.8245	79.8274	77.3775	69.7138	68.7673	71.4836	72.2580	80.5919	85.7267	95.5615	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994	(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 1 509.3557 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 291.3816
Water heating fuel used 974.2373 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 182.1696 (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 1665.7625 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	509.3557	16.4900	83.9928	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.2373	16.4900	160.6517	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	182.1696	16.4900	30.0398	(250)
Additional standing charges			0.0000	(251)
Total energy cost			274.6842	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7550 (257)
SAP value 87.7610
SAP rating (Section 12) 88 (258)

SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	509.3557	0.1573	80.0995	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.2373	0.1409	137.2542	(264)
Space and water heating			217.3537	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			243.6464	(272)
CO2 emissions per m2			2.8300	(273)
EI value			97.5072	
EI rating			98	(274)
EI band			A	

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2896	(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) =	0.2896	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3330	0.3185	0.3185	0.2896	0.2896	0.2534	0.2679	0.2679	0.2679	0.2823	0.2823	0.3113	(22b)
Effective ac	0.5555	0.5507	0.5507	0.5419	0.5419	0.5321	0.5359	0.5359	0.5359	0.5399	0.5399	0.5485	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	65.9800	22.2000	43.7800	0.1500	6.5670	70.0000	3064.6000	(29a)
HALLWAY	16.9300		16.9300	0.1400	2.3702	70.0000	1185.1000	(29a)
Total net area of external elements Aum(A, m2)			82.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.3280			(33)
Party Wall 1			24.1300	0.0000	0.0000	180.0000	4343.4000	(32)

Party Floor 1	85.9700	40.0000	3438.8000 (32d)
Party Ceiling 1	85.9700	40.0000	3438.8000 (32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15470.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	179.9546 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	66.3000	0.0700	4.6410
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	19.3000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.0420 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 43.3700 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3955	39.0610	39.0610	38.4365	38.4365	37.7395	38.0071	38.0071	38.0071	38.2896	38.2896	38.8993	(38)
Heat transfer coeff	82.7655	82.4310	82.4310	81.8065	81.8065	81.1095	81.3771	81.3771	81.3771	81.6596	81.6596	82.2693	(39)

Average = Sum(39)m / 12 = 81.8392

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9627	0.9588	0.9588	0.9516	0.9516	0.9435	0.9466	0.9466	0.9466	0.9499	0.9499	0.9570	(40)
HLP (average)												0.9520	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5664	(42)
Hot water usage for mixer showers	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)
Hot water usage for baths	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)
Hot water usage for other uses	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)
Average daily hot water use (litres/day)												129.4988	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
										Total per year (kWh/year) = Sum(64)m =		2838.7482	(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	120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)													

	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)												
	162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477 (72)
Total internal gains												
	638.0861	636.1990	617.9220	583.3094	548.8165	517.4040	498.6190	501.4547	518.9108	550.3840	588.6292	622.1739 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439 (83)
Total gains	784.5450	893.2799	1042.0023	1219.7275	1306.0498	1344.1943	1284.0766	1198.7822	1059.7763	883.3491	777.2013	740.4178 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.9228	52.1335	52.1335	52.5315	52.5315	52.9829	52.8087	52.8087	52.8087	52.6260	52.6260	52.2360	
alpha	4.4615	4.4756	4.4756	4.5021	4.5021	4.5322	4.5206	4.5206	4.5206	4.5084	4.5084	4.4824	
util living area													
	0.9545	0.9251	0.8346	0.6634	0.4671	0.2770	0.1647	0.1900	0.4101	0.7309	0.9142	0.9622	(86)
Living	20.0916	20.2848	20.6338	20.8889	20.9803	20.9986	20.9999	20.9998	20.9919	20.8636	20.4513	20.0422	
Non living	19.0904	19.3288	19.7416	20.0235	20.1098	20.1301	20.1281	20.1281	20.1237	20.0077	19.5428	19.0334	
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	20.5353	20.2848	20.6338	20.8889	20.9803	20.9986	20.9999	20.9998	20.9919	20.8636	20.4513	20.1762	(87)
Th 2	20.1145	20.1178	20.1178	20.1239	20.1239	20.1307	20.1281	20.1281	20.1281	20.1253	20.1253	20.1194	(88)
util rest of house													
	0.9450	0.9107	0.8066	0.6207	0.4161	0.2249	0.1095	0.1309	0.3458	0.6801	0.8949	0.9541	(89)
MIT 2	19.7062	19.3288	19.7416	20.0235	20.1098	20.1301	20.1281	20.1281	20.1237	20.0077	19.5428	19.2291	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	20.0727	19.7513	20.1359	20.4060	20.4946	20.5140	20.5134	20.5134	20.5074	20.3860	19.9444	19.6477	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0727	19.7513	20.1359	20.4060	20.4946	20.5140	20.5134	20.5134	20.5074	20.3860	19.9444	19.6477	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9445	0.9038	0.8073	0.6348	0.4379	0.2479	0.1339	0.1570	0.3740	0.6960	0.8903	0.9489	(94)
Useful gains	740.9993	807.3601	841.1575	774.3181	571.9155	333.2321	171.9691	188.2207	396.3201	614.7917	691.9523	702.5798	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W													
	1214.3937	1150.0230	1016.8638	826.7355	580.3816	333.6861	171.9859	188.2575	399.3532	676.6332	950.8761	1172.1487	(97)
Space heating kWh													
	352.2054	230.2695	130.7255	37.7405	6.2988	0.0000	0.0000	0.0000	0.0000	46.0101	186.4251	349.3593	(98a)
Space heating requirement - total per year (kWh/year)												1339.0343	
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													
	352.2054	230.2695	130.7255	37.7405	6.2988	0.0000	0.0000	0.0000	0.0000	46.0101	186.4251	349.3593	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1339.0343	
Space heating per m2										(98c) / (4) =		15.5756	(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 %)	337.0850	(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													
	352.2054	230.2695	130.7255	37.7405	6.2988	0.0000	0.0000	0.0000	0.0000	46.0101	186.4251	349.3593	(98)
Space heating efficiency (main heating system 1)													
	337.0850	337.0850	337.0850	337.0850	337.0850	0.0000	0.0000	0.0000	0.0000	337.0850	337.0850	337.0850	(210)
Space heating fuel (main heating system)													
	104.4857	68.3120	38.7812	11.1961	1.8686	0.0000	0.0000	0.0000	0.0000	13.6494	55.3051	103.6413	(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												
	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488 (64)
Efficiency of water heater												291.4124 (216)
(217)m	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124	291.4124 (217)
Fuel for water heating, kWh/month												
	96.6155	85.4703	90.8149	79.8190	77.3694	69.7064	68.7600	71.4761	72.2503	80.5834	85.7176	95.5514 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	397.2394 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.4124
Water heating fuel used	974.1343 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	1553.5432 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	397.2394	18.3900	73.0523	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.1343	18.3900	179.1433	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	182.1696	18.3900	33.5010	(250)
Additional standing charges			0.0000	(251)
Total energy cost			285.6966	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	397.2394	0.1582	62.8432	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.1343	0.1409	137.2397	(264)
Space and water heating			200.0829	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			226.3756	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	397.2394	1.5856	629.8594	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.1343	1.5209	1481.5961	(278)

Space and water heating			2111.4555 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	182.1696	1.5338	279.4177 (282)
Total Primary energy kWh/year			2390.8732 (286)

Building Regulations England Part L (BREL) Compliance Report

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

Date: Sun 02 Jul 2023 20:29:42

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/004083	Assessment Date	2023-07-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	86 m^2
Site Reference	Fortess Road	Plot Reference	Flat 3 - Boiler
Address	Flat 1 7 Fortess Road, LONDON, NW5 1AA		

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	*12.56 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	13.18 $kgCO_2/m^2$	**FAIL**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*66.73 kWh_{PE}/m^2*	
Dwelling primary energy	73.27 kWh_{PE}/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*34.3 kWh/m^2*	
Dwelling fabric energy efficiency	30.8 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	**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*	1.1	Opening (1.1)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Sheltered wall: Walls (1)	60.32	0.15
Exposed wall: Walls (2)	16.98	0.15
Party wall: Party Wall (1)	7.58	0 **(!)**
Exposed roof: Roof (1)	11.27	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^2K]**
Opening, WINDOWS	12.36	East	0.7	1.1 **(!)**
Opening, WINDOWS	1.98	West	0.7	1.1 **(!)**
Opening, WINDOWS	7.86	West	0.7	1.1 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
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	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	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

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	83.7%
Emitter type	Underfloor
Flow temperature	
System type	Combi boiler
Manufacturer	Vaillant
Model	ecoFIT sustain 835
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

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

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
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: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Summary for Input Data

elmhurst energy

Property Reference	Fortess Road	**Issued on Date**	02/07/2023
Assessment Reference	Flat 3 - Boiler	**Prop Type Ref**	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	**DER**	13.18	**TER**	12.56
Environmental	89 B	**% DER < TER**			-4.94
CO_2 Emissions (t/year)	1	**DFEE**	30.83	**TFEE**	34.33
Compliance Check	See BREL	**% DFEE < TFEE**			10.21
% DPER < TPER	-9.79	**DPER**	73.27	**TPER**	66.73

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

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

Orientation	East	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	3	
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/m²K
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 m²	0.00 m
Ground floor:	1.00 m	85.97 m²	2.50 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	38.00	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	82.52	60.32	0.50	Stairwell Access Corridor 1	22.20	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	16.98	16.98	0.00	None	0.00	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	7.58	0.00	None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	11.27	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data

elmhurst energy

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	74.70

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	85.97

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	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	WINDOWS	EXTERNAL	East	12.36	0
Opening	WINDOWS	EXTERNAL	West	1.98	0
Opening	WINDOWS	EXTERNAL	West	7.86	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	11.04	0.30	0.30	No
E3 Sill	Independently assessed	6.70	0.04	0.04	No
E4 Jamb	Independently assessed	47.42	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	38.92	0.07	0.07	No
E16 Corner (normal)	Independently assessed	2.50	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.50	-0.09	-0.09	No
E18 Party wall between dwellings	Independently assessed	7.50	0.06	0.06	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	5.69	0.00	0.00	No
E14 Flat roof	Independently assessed	22.48	0.04	0.04	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.37	0.12	0.12	No

Y-value	0.09	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP_{50}	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	11

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	17960	
Fuel Type	Mains gas	
SAP Code	0	
In Winter	88.70	
In Summer	76.40	
Model Name	ecoFIT sustain 835	

Summary for Input Data

Manufacturer	Vaillant
System Type	Combi 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	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Unknown
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2 — None

26.0 Heat Networks — 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
Bath Count	1
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 — None

Cylinder Stat	No
Cylinder In Heated Space	No
Independent Time Control	No
In Airing Cupboard	No

31.0 Thermal Store — None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Summary for Input Data

None

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 3 - Boiler	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	DER	13.18	TER	12.56
Environmental	89 B	% DER < TER			-4.94
CO_2 Emissions (t/year)	1	DFEE	30.83	TFEE	34.33
Compliance Check	See BREL	% DFEE < TFEE			10.21
% DPER < TPER	-9.79	DPER	73.27	TPER	66.73

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700	(1b)	x 2.5000	(2b) =	214.9250	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.9250	(5)

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2896	(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) =	0.2896	(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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)

Party Ceiling 1	74.7000	30.0000	2241.0000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12556.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 146.0583 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.6913 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	85.9883	85.8006	85.6166	84.7523	84.5906	83.8378	83.8378	83.6984	84.1278	84.5906	84.9177	85.2597	(39)

Average = Sum(39)m / 12 = 84.7515

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0002	0.9980	0.9959	0.9858	0.9840	0.9752	0.9752	0.9736	0.9786	0.9840	0.9878	0.9917	(40)
HLP (average)												0.9858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)
Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422
Distribution loss (46)m = 0.15 x (45)m

33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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 0.6409	0.5877	0.6477	0.5922	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)	

Total heat required for water heating calculated for each month

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)

Total per year (kWh/year) = Sum(64)m = 2157.9970 (64)
12Total per year (kWh/year) 2158 (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

74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.7476	129.2563	116.7476	120.6392	116.7476	120.6392	116.7476	116.7476	120.6392	116.7476	120.6392	116.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.4653	233.8671	227.8145	214.9291	198.6635	183.3762	173.1633	170.7615	176.8141	189.6996	205.9651	221.2524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)

Water heating gains (Table 5)

	99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478 (72)
Total internal gains	512.6451	524.9703	501.4422	481.5809	454.7618	433.4037	415.0322	416.1703	430.2626	449.9807	480.5563	501.0445 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887 (76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628 (80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796 (83)
Total gains	645.8966	785.6385	930.7256	1107.6651	1222.0515	1218.8613	1162.8198	1058.5089	929.5370	759.2855	646.7052	610.6241 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.5631	40.6519	40.7392	41.1547	41.2333	41.6036	41.6036	41.6729	41.4602	41.2333	41.0745	40.9097	
alpha	3.7042	3.7101	3.7159	3.7436	3.7489	3.7736	3.7736	3.7782	3.7640	3.7489	3.7383	3.7273	
util living area	0.9708	0.9429	0.8845	0.7578	0.5936	0.4288	0.3144	0.3586	0.5799	0.8433	0.9494	0.9757	(86)
MIT	19.4338	19.7589	20.1893	20.6381	20.8807	20.9730	20.9935	20.9894	20.9193	20.5343	19.8996	19.3764	(87)
Th 2	20.0832	20.0850	20.0868	20.0952	20.0967	20.1041	20.1041	20.1054	20.1012	20.0967	20.0935	20.0902	(88)
util rest of house	0.9655	0.9330	0.8659	0.7243	0.5468	0.3725	0.2516	0.2910	0.5168	0.8111	0.9390	0.9712	(89)
MIT 2	18.2607	18.6684	19.1978	19.7296	19.9916	20.0855	20.1010	20.1001	20.0399	19.6288	18.8566	18.1931	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	18.7792	19.1504	19.6361	20.1312	20.3846	20.4778	20.4955	20.4932	20.4286	20.0290	19.3176	18.7162	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7792	19.1504	19.6361	20.1312	20.3846	20.4778	20.4955	20.4932	20.4286	20.0290	19.3176	18.7162	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9557	0.9209	0.8554	0.7257	0.5621	0.3963	0.2792	0.3206	0.5405	0.8084	0.9280	0.9623	(94)
Useful gains	617.2538	723.4808	796.1866	803.8423	686.8958	483.0231	324.6377	339.3136	502.3782	613.8114	600.1280	587.5825	(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	1245.0418	1222.6934	1124.6660	951.8690	734.6374	492.7805	326.5906	342.5941	532.4118	797.6065	1037.4905	1237.6426	(97)
Space heating kWh	467.0743	335.4709	244.3887	106.5792	35.5198	0.0000	0.0000	0.0000	0.0000	136.7435	314.9010	483.6447	(98a)
Space heating requirement - total per year (kWh/year)												2124.3221	
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	467.0743	335.4709	244.3887	106.5792	35.5198	0.0000	0.0000	0.0000	0.0000	136.7435	314.9010	483.6447	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2124.3221	
Space heating per m2										(98c) / (4) =		24.7100	(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 %)	83.7000 (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	467.0743	335.4709	244.3887	106.5792	35.5198	0.0000	0.0000	0.0000	0.0000	136.7435	314.9010	483.6447	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	558.0338	400.8015	291.9817	127.3348	42.4370	0.0000	0.0000	0.0000	0.0000	163.3734	376.2258	577.8312	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)

Efficiency of water heater												76.4000 (216)
(217)m	84.3037	83.7153	82.6034	80.6059	78.2983	76.4000	76.4000	76.4000	76.4000	81.3146	83.5732	84.4407 (217)
Fuel for water heating, kWh/month												
	265.4381	235.1967	250.4463	219.1682	214.1037	192.6037	186.5184	196.8890	202.2976	217.6696	231.9588	261.3284 (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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	2538.0192 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2673.6187 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	5479.8074 (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	2538.0192	0.2100	532.9840	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2673.6187	0.2100	561.4599	(264)
Space and water heating			1094.4440	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			1132.6659	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.1800	(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	2538.0192	1.1300	2867.9617	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2673.6187	1.1300	3021.1891	(278)
Space and water heating			5889.1508	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			6298.6693	(286)
Dwelling Primary energy Rate (DPER)			73.2700	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3896	(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) =	0.3896	(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	0.4967	0.4870	0.4772	0.4285	0.4188	0.3701	0.3701	0.3604	0.3896	0.4188	0.4383	0.4578	(22b)
Effective ac	0.6234	0.6186	0.6139	0.5918	0.5877	0.5685	0.5685	0.5649	0.5759	0.5877	0.5960	0.6048	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			21.5000	1.1450	24.6183			(27)
EXTERNAL	82.5200	21.5000	61.0200	0.1800	10.9836			(29a)
HALLWAY	16.9800		16.9800	0.1800	3.0564			(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397			(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8980			(33)
Party Wall 1			7.5800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 154.7474 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	11.0400	0.0500	0.5520
E3	Sill	6.7000	0.0500	0.3350
E4	Jamb	47.4200	0.0500	2.3710
E7	Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16	Corner (normal)	2.5000	0.0900	0.2250
E17	Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18	Party wall between dwellings	7.5000	0.0600	0.4500
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14	Flat roof	22.4800	0.0800	1.7984
P4	Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.2752 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 48.1732 (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	44.2123	43.8726	43.5395	41.9753	41.6826	40.3202	40.3202	40.0679	40.8450	41.6826	42.2747	42.8936	(38)
Heat transfer coeff	92.3855	92.0458	91.7127	90.1485	89.8558	88.4934	88.4934	88.2411	89.0182	89.8558	90.4479	91.0669	(39)
Average = Sum(39)m / 12 =												90.1471	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0746	1.0707	1.0668	1.0486	1.0452	1.0294	1.0294	1.0264	1.0355	1.0452	1.0521	1.0593	(40)
HLP (average)												1.0486	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)

Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929 (42a)

Hot water usage for baths

29.0432	28.6119	28.0044	26.8845	26.0459	25.1160	24.6137	25.2169	25.8736	26.8686	28.0116	28.9450 (42b)

Hot water usage for other uses

40.9130	39.4252	37.9375	36.4497	34.9620	33.4743	33.4743	34.9620	36.4497	37.9375	39.4252	40.9130 (42c)

Average daily hot water use (litres/day) 126.1240 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.2068	134.2771	130.7092	125.2837	120.8779	116.1414	114.3210	117.8734	121.6201	126.5927	132.1017	136.8509	(44)
Energy conte	217.3020	191.2087	200.8952	171.5072	162.7250	142.8093	138.2613	145.9519	149.9697	171.7851	188.2031	214.2755	(45)

Energy content (annual) Total = Sum(45)m = 2094.8940

Distribution loss (46)m = 0.15 x (45)m

32.5953	28.6813	30.1343	25.7261	24.4087	21.4214	20.7392	21.8928	22.4955	25.7678	28.2305	32.1413 (46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss 50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)

Total heat required for water heating calculated for each month

268.2609	237.2361	251.8541	220.8222	213.6839	192.1244	189.2202	196.9109	199.2848	222.7440	237.5182	265.2344 (62)
WWHRS -30.7442	-27.1904	-28.4722	-23.5761	-21.9721	-18.8017	-17.6236	-18.7409	-19.4529	-22.9329	-25.9802	-30.1748 (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

237.5167	210.0457	223.3818	197.2461	191.7118	173.3227	171.5966	178.1699	179.8318	199.8111	211.5380	235.0595 (64)

Total per year (kWh/year) = Sum(64)m = 2409.2320 (64)

12Total per year (kWh/year) 2409 (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

84.9926	75.0838	79.5374	69.3549	66.8458	59.8129	58.7116	61.2687	62.1937	69.8583	74.9063	83.9863 (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	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

116.7476	129.2563	116.7476	120.6392	116.7476	120.6392	116.7476	116.7476	120.6392	116.7476	120.6392	116.7476 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

231.4653	233.8671	227.8145	214.9291	198.6635	183.3762	173.1633	170.7615	176.8141	189.6996	205.9651	221.2524 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322 (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)

-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579 (71)

Water heating gains (Table 5)

114.2374	111.7318	106.9051	96.3263	89.8465	83.0734	78.9135	82.3505	86.3801	93.8955	104.0365	112.8848 (72)

Total internal gains

526.9470	539.3519	515.9639	496.3912	469.7543	448.5856	430.3212	431.3563	445.3302	464.8394	495.1376	515.3816 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.9700	19.6403	0.6300	0.7000	0.7700	71.8478	(76)
West	9.5300	19.6403	0.6300	0.7000	0.7700	57.2021	(80)

Solar gains	129.0499	252.4489	415.7474	606.3429	743.0959	760.6909	724.2088	622.0846	483.5315	299.5519	160.9100	106.1243	(83)
Total gains	655.9969	791.8009	931.7113	1102.7341	1212.8503	1209.2765	1154.5299	1053.4409	928.8617	764.3914	656.0476	621.5059	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.0003	40.1480	40.2938	40.9930	41.1265	41.7596	41.7596	41.8790	41.5135	41.1265	40.8573	40.5796	
alpha	3.6667	3.6765	3.6863	3.7329	3.7418	3.7840	3.7840	3.7919	3.7676	3.7418	3.7238	3.7053	
util living area	0.9745	0.9509	0.9006	0.7844	0.6249	0.4538	0.3336	0.3789	0.6065	0.8603	0.9555	0.9786	(86)
MIT	19.3554	19.6717	20.1049	20.5861	20.8573	20.9677	20.9922	20.9875	20.9064	20.4920	19.8457	19.3155	(87)
Th 2	20.0216	20.0249	20.0280	20.0430	20.0458	20.0589	20.0589	20.0614	20.0539	20.0458	20.0402	20.0342	(88)
util rest of house													

	0.9695	0.9417	0.8827	0.7505	0.5748	0.3919	0.2638	0.3043	0.5388	0.8283	0.9456	0.9743 (89)
MIT 2	18.1147	18.5132	19.0491	19.6269	19.9216	20.0374	20.0554	20.0554	19.9842	19.5383	18.7477	18.0727 (90)
Living area fraction										fLA = Living area / (4) =		0.4420 (91)
MIT	18.6631	19.0253	19.5158	20.0509	20.3352	20.4486	20.4695	20.4674	20.3918	19.9599	19.2330	18.6220 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6631	19.0253	19.5158	20.0509	20.3352	20.4486	20.4695	20.4674	20.3918	19.9599	19.2330	18.6220 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9603	0.9300	0.8718	0.7508	0.5905	0.4180	0.2945	0.3369	0.5639	0.8251	0.9351	0.9661	(94)
Useful gains	629.9691	736.3528	812.2911	827.8995	716.1914	505.4204	339.9938	354.8982	523.7685	630.6731	613.4534	600.4142	(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													
	1326.9468	1300.1707	1193.7131	1005.2337	775.9243	517.5624	342.4245	358.9103	560.0888	841.0381	1097.4069	1313.3706	(97)
Space heating kWh													
	518.5514	378.8856	283.7780	127.6806	44.4413	0.0000	0.0000	0.0000	0.0000	156.5116	348.4465	530.4396	(98a)
Space heating requirement - total per year (kWh/year)												2388.7346	
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													
	518.5514	378.8856	283.7780	127.6806	44.4413	0.0000	0.0000	0.0000	0.0000	156.5116	348.4465	530.4396	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2388.7346	
Space heating per m2											(98c) / (4) =	27.7857	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	518.5514	378.8856	283.7780	127.6806	44.4413	0.0000	0.0000	0.0000	0.0000	156.5116	348.4465	530.4396	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	561.2028	410.0494	307.1191	138.1825	48.0966	0.0000	0.0000	0.0000	0.0000	169.3848	377.1066	574.0688	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	237.5167	210.0457	223.3818	197.2461	191.7118	173.3227	171.5966	178.1699	179.8318	199.8111	211.5380	235.0595	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.0063	85.6292	84.8953	83.4731	81.7890	80.3000	80.3000	80.3000	80.3000	83.8635	85.4432	86.0695	(217)
Fuel for water heating, kWh/month													
	276.1619	245.2969	263.1263	236.2990	234.3981	215.8440	213.6945	221.8804	223.9500	238.2576	247.5773	273.1044	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.2579	19.4606	17.5221	12.8374	9.9160	8.1015	9.0457	11.7579	15.2724	20.0382	22.6331	24.9321	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.9049	-28.2721	-43.0757	-51.4271	-58.0976	-55.1887	-54.5046	-50.1294	-42.9016	-33.6087	-21.3471	-16.1603	(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	-6.2705	-13.5272	-27.5296	-42.3151	-56.9190	-57.5581	-56.8934	-47.7351	-34.4127	-19.6699	-8.4734	-4.9347	(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												2585.2106	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2889.5903	(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)												195.7748	(232)

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

PV generation	-849.8565 (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	4906.7191 (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	2585.2106	0.2100	542.8942	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2889.5903	0.2100	606.8140	(264)
Space and water heating			1149.7082	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	195.7748	0.1443	28.2564	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.6177	0.1334	-63.1680	
PV Unit electricity exported	-376.2388	0.1252	-47.1123	
Total			-110.2804	(269)
Total CO2, kg/year			1079.6134	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5600	(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	2585.2106	1.1300	2921.2880	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2889.5903	1.1300	3265.2370	(278)
Space and water heating			6186.5250	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	195.7748	1.5338	300.2859	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.6177	1.4929	-707.0434	
PV Unit electricity exported	-376.2388	0.4596	-172.9222	
Total			-879.9656	(283)
Total Primary energy kWh/year			5736.9461	(286)
Target Primary Energy Rate (TPER)			66.7300	(287)

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 3 - Boiler	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	86 B	DER	13.18	TER	12.56
Environmental	89 B	% DER < TER			-4.94
CO_2 Emissions (t/year)	1	DFEE	30.83	TFEE	34.33
Compliance Check	See BREL	% DFEE < TFEE			10.21
% DPER < TPER	-9.79	DPER	73.27	TPER	66.73

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 ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700	(1b)	x 2.5000	(2b) =	214.9250	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.9250	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)

Party Ceiling 1	74.7000	40.0000	2988.0000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13303.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 154.7474 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.6913 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	85.9883	85.8006	85.6166	84.7523	84.5906	83.8378	83.8378	83.6984	84.1278	84.5906	84.9177	85.2597	(39)

Average = Sum(39)m / 12 = 84.7515

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0002	0.9980	0.9959	0.9858	0.9840	0.9752	0.9752	0.9736	0.9786	0.9840	0.9878	0.9917	(40)
HLP (average)												0.9858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)
Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422
Distribution loss (46)m = 0.15 x (45)m

33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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 0.6409	0.5877	0.6477	0.5922	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)	

Total heat required for water heating calculated for each month

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)

Total per year (kWh/year) = Sum(64)m = 2157.9970 (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

74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)

-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)

Water heating gains (Table 5)

99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478	(72)

Total internal gains	578.4881	576.6043	558.3263	523.7017	489.2022	454.7810	435.9876	438.8260	456.2853	490.7667	529.0227	562.5740 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	711.7396	837.2725	987.6097	1149.7859	1256.4919	1240.2386	1183.7753	1081.1646	955.5596	800.0715	695.1716	672.1536	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.9762	43.0703	43.1628	43.6030	43.6863	44.0786	44.0786	44.1520	43.9267	43.6863	43.5180	43.3435	
alpha	3.8651	3.8714	3.8775	3.9069	3.9124	3.9386	3.9386	3.9435	3.9284	3.9124	3.9012	3.8896	
util living area	0.9654	0.9379	0.8747	0.7484	0.5844	0.4234	0.3094	0.3522	0.5707	0.8324	0.9437	0.9713	(86)
MIT	19.6094	19.8924	20.2981	20.6923	20.9024	20.9787	20.9952	20.9920	20.9343	20.6013	20.0231	19.5493	(87)
Th 2	20.0832	20.0850	20.0868	20.0952	20.0967	20.1041	20.1041	20.1054	20.1012	20.0967	20.0935	20.0902	(88)
util rest of house	0.9590	0.9270	0.8545	0.7137	0.5372	0.3673	0.2474	0.2854	0.5071	0.7981	0.9319	0.9659	(89)
MIT 2	18.4757	18.8292	19.3249	19.7883	20.0123	20.0898	20.1019	20.1015	20.0526	19.7022	19.0044	18.4052	(90)
Living area fraction									fLA = Living area / (4) =			0.4420	(91)
MIT	18.9768	19.2992	19.7551	20.1879	20.4057	20.4827	20.4967	20.4952	20.4423	20.0996	19.4547	18.9109	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9768	19.2992	19.7551	20.1879	20.4057	20.4827	20.4967	20.4952	20.4423	20.0996	19.4547	18.9109	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9492	0.9159	0.8462	0.7174	0.5538	0.3913	0.2747	0.3147	0.5319	0.7982	0.9219	0.9570	(94)
Useful gains	675.5960	766.8443	835.7507	824.8640	695.7878	485.2467	325.2049	340.2264	508.2508	638.5955	640.8564	643.2197	(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	1262.0358	1235.4573	1134.8529	956.6764	736.4217	493.1917	326.6925	342.7585	533.5649	803.5796	1049.1322	1254.2466	(97)
Space heating kWh	436.3112	314.9079	222.5320	94.9049	30.2317	0.0000	0.0000	0.0000	0.0000	122.7482	293.9585	454.6040	(98a)
Space heating requirement - total per year (kWh/year)												1970.1985	
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	436.3112	314.9079	222.5320	94.9049	30.2317	0.0000	0.0000	0.0000	0.0000	122.7482	293.9585	454.6040	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1970.1985	
Space heating per m2											(98c) / (4) =	22.9173	(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 %)	83.7000	(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	436.3112	314.9079	222.5320	94.9049	30.2317	0.0000	0.0000	0.0000	0.0000	122.7482	293.9585	454.6040	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	521.2798	376.2341	265.8686	113.3870	36.1191	0.0000	0.0000	0.0000	0.0000	146.6526	351.2049	543.1350	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
Efficiency of water heater												76.4000	(216)

(217)m	84.1094	83.5267	82.3154	80.2910	78.0537	76.4000	76.4000	76.4000	76.4000	80.9997	83.3663	84.2667 (217)
Fuel for water heating, kWh/month												
	266.0512	235.7278	251.3225	220.0279	214.7747	192.6037	186.5184	196.8890	202.2976	218.5158	232.5344	261.8681 (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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	2353.8811 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2679.1312 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	5301.1819 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2353.8811	3.6400	85.6813	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2679.1312	3.6400	97.5204	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	182.1696	16.4900	30.0398	(250)
Additional standing charges			92.0000	(251)
Total energy cost			319.4228	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8780	(257)
SAP value		85.7676	
SAP rating (Section 12)		86	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2353.8811	0.2100	494.3150	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2679.1312	0.2100	562.6176	(264)
Space and water heating			1056.9326	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			1095.1545	(272)
CO2 emissions per m2			12.7400	(273)
EI value			88.7951	
EI rating			89	(274)
EI band			B	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3330	0.3185	0.3185	0.2896	0.2896	0.2534	0.2679	0.2679	0.2679	0.2823	0.2823	0.3113	(22b)
Effective ac	0.5555	0.5507	0.5507	0.5419	0.5419	0.5321	0.5359	0.5359	0.5359	0.5399	0.5399	0.5485	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			74.7000			40.0000	2988.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13303.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		154.7474 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0690 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	45.6913 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3955	39.0610	39.0610	38.4365	38.4365	37.7395	38.0071	38.0071	38.0071	38.2896	38.2896	38.8993	(38)
Heat transfer coeff	85.0868	84.7523	84.7523	84.1278	84.1278	83.4308	83.6984	83.6984	83.6984	83.9809	83.9809	84.5906	(39)
Average = Sum(39)m / 12 =												84.1605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9897	0.9858	0.9858	0.9786	0.9786	0.9705	0.9736	0.9736	0.9736	0.9769	0.9769	0.9840	(40)
HLP (average)												0.9790	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)

Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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	0.6409	0.5877	0.6477	0.5922	0.5921	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)
Total heat required for water heating calculated for each month	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
									Total per year (kWh/year) = Sum(64)m =			2157.9970	(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	74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)	99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478	(72)
Total internal gains	578.4881	576.6043	558.3263	523.7017	489.2022	454.7810	435.9876	438.8260	456.2853	490.7667	529.0227	562.5740	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	724.9470	833.6852	982.4066	1160.1198	1246.4354	1281.5713	1221.4452	1136.1535	997.1508	823.7319	717.5947	680.8179	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4315	43.6030	43.6030	43.9267	43.9267	44.2936	44.1520	44.1520	44.1520	44.0035	44.0035	43.6863	
alpha	3.8954	3.9069	3.9069	3.9284	3.9284	3.9529	3.9435	3.9435	3.9435	3.9336	3.9336	3.9124	
util living area	0.9546	0.9269	0.8444	0.6860	0.4941	0.2977	0.1780	0.2059	0.4421	0.7568	0.9198	0.9622	(86)
MIT	19.8170	20.0391	20.4610	20.8051	20.9561	20.9957	20.9996	20.9993	20.9792	20.7683	20.2404	19.7606	(87)
Th 2	20.0919	20.0952	20.0952	20.1012	20.1012	20.1080	20.1054	20.1054	20.1054	20.1027	20.1027	20.0967	(88)
util rest of house	0.9460	0.9138	0.8190	0.6447	0.4411	0.2407	0.1168	0.1403	0.3730	0.7094	0.9028	0.9548	(89)
MIT 2	18.7434	19.0195	19.5271	19.9176	20.0678	20.1060	20.1053	20.1053	20.0931	19.8923	19.2793	18.6771	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	19.2180	19.4701	19.9399	20.3099	20.4604	20.4992	20.5006	20.5004	20.4848	20.2795	19.7041	19.1560	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2180	19.4701	19.9399	20.3099	20.4604	20.4992	20.5006	20.5004	20.4848	20.2795	19.7041	19.1560	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9357	0.9032	0.8142	0.6547	0.4626	0.2658	0.1439	0.1693	0.4027	0.7194	0.8939	0.9451	(94)
Useful gains	678.3163	753.0053	799.8570	759.5042	576.6213	340.6481	175.7475	192.3980	401.5910	592.5655	641.4629	643.4385	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1175.7269	1158.5758	1028.8826	842.1111	593.9791	342.0033	175.8196	192.5439	408.8492	686.9227	957.7266	1163.6283	(97)
Space heating kWh	370.0735	272.5434	170.3951	59.4770	12.9142	0.0000	0.0000	0.0000	0.0000	70.2017	227.7099	387.0212	(98a)
Space heating requirement - total per year (kWh/year)												1570.3359	
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	370.0735	272.5434	170.3951	59.4770	12.9142	0.0000	0.0000	0.0000	0.0000	70.2017	227.7099	387.0212	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1570.3359	
Space heating per m2										(98c) / (4) =		18.2661	(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 %) 83.7000 (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	370.0735	272.5434	170.3951	59.4770	12.9142	0.0000	0.0000	0.0000	0.0000	70.2017	227.7099	387.0212	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	442.1428	325.6193	203.5783	71.0597	15.4292	0.0000	0.0000	0.0000	0.0000	83.8730	272.0548	462.3909	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
Efficiency of water heater												76.4000	(216)
(217)m	83.6267	83.0893	81.5047	79.1650	77.1654	76.4000	76.4000	76.4000	76.4000	79.5320	82.5859	83.8009	(217)
Fuel for water heating, kWh/month	267.5870	236.9685	253.8225	223.1574	217.2472	192.6037	186.5184	196.8890	202.2976	222.5482	234.7317	263.3237	(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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994	(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	1876.1480 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2697.6951 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	4842.0127 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1876.1480	3.5000	65.6652	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2697.6951	3.5000	94.4193	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154	(249)
Energy for lighting	182.1696	18.3900	33.5010	(250)
Additional standing charges			94.0000	(251)
Total energy cost			303.4009	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1876.1480	0.2100	393.9911	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2697.6951	0.2100	566.5160	(264)
Space and water heating			960.5071	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			998.7290	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1876.1480	1.1300	2120.0473	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2697.6951	1.1300	3048.3955	(278)
Space and water heating			5168.4428	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			5577.9613	(286)

SAP 10 EPC IMPROVEMENTS

Flat 3 - Boiler

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 89

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: B 86
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£49	£49	£0
Mains gas	£254	£254	£0
Space heating	£175	£175	£0
Water heating	£94	£94	£0
Lighting	£34	£34	£0
Total cost of fuels	£303	£303	£0
Total cost of uses	£303	£303	£0
Delivered energy	56 kWh/m²	56 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	65 kWh/m²	65 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250 (5)	

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2896	(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) =	0.2896	(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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			74.7000			40.0000	2988.0000	(32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13303.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 154.7474 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.6913 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	85.9883	85.8006	85.6166	84.7523	84.5906	83.8378	83.8378	83.6984	84.1278	84.5906	84.9177	85.2597	(39)

Average = Sum(39)m / 12 = 84.7515

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0002	0.9980	0.9959	0.9858	0.9840	0.9752	0.9752	0.9736	0.9786	0.9840	0.9878	0.9917	(40)
HLP (average)												0.9858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422
Distribution loss (46)m = 0.15 x (45)m

33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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)
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)
0.6409	0.5877	0.6477	0.5922	0.5921	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(62)
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)
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)
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)
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)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)

Total per year (kWh/year) = Sum(64)m = 2157.9970 (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

74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
25.7880 22.9047 18.6273 14.1021 10.5415 8.8996 9.6163 12.4996 16.7769 21.3022 24.8628 26.5047 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
345.4705 349.0554 340.0216 320.7896 296.5127 273.6958 258.4528 254.8679 263.9017 283.1337 307.4106 330.2275 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
52.9651 52.9651 52.9651 52.9651 52.9651 52.9651 52.9651 52.9651 52.9651 52.9651 52.9651 52.9651 (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)
-102.6579 -102.6579 -102.6579 -102.6579 -102.6579 -102.6579 -102.6579 -102.6579 -102.6579 -102.6579 -102.6579 -102.6579 (71)
Water heating gains (Table 5)
99.9355 97.3501 92.3833 81.5159 74.8539 67.8915 63.6245 67.1645 71.3126 79.0368 89.4552 98.5478 (72)
Total internal gains
578.4881 576.6043 558.3263 523.7017 489.2022 454.7810 435.9876 438.8260 456.2853 490.7667 529.0227 562.5740 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796 (83)
Total gains	711.7396	837.2725	987.6097	1149.7859	1256.4919	1240.2386	1183.7753	1081.1646	955.5596	800.0715	695.1716	672.1536 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.9762	43.0703	43.1628	43.6030	43.6863	44.0786	44.0786	44.1520	43.9267	43.6863	43.5180	43.3435	
alpha	3.8651	3.8714	3.8775	3.9069	3.9124	3.9386	3.9386	3.9435	3.9284	3.9124	3.9012	3.8896	
util living area	0.9654	0.9379	0.8747	0.7484	0.5844	0.4234	0.3094	0.3522	0.5707	0.8324	0.9437	0.9713	(86)
MIT	19.6094	19.8924	20.2981	20.6923	20.9024	20.9787	20.9952	20.9920	20.9343	20.6013	20.0231	19.5493	(87)
Th 2	20.0832	20.0850	20.0868	20.0952	20.0967	20.1041	20.1041	20.1054	20.1012	20.0967	20.0935	20.0902	(88)
util rest of house	0.9590	0.9270	0.8545	0.7137	0.5372	0.3673	0.2474	0.2854	0.5071	0.7981	0.9319	0.9659	(89)
MIT 2	18.4757	18.8292	19.3249	19.7883	20.0123	20.0898	20.1019	20.1015	20.0526	19.7022	19.0044	18.4052	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	18.9768	19.2992	19.7551	20.1879	20.4057	20.4827	20.4967	20.4952	20.4423	20.0996	19.4547	18.9109	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9768	19.2992	19.7551	20.1879	20.4057	20.4827	20.4967	20.4952	20.4423	20.0996	19.4547	18.9109	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9492	0.9159	0.8462	0.7174	0.5538	0.3913	0.2747	0.3147	0.5319	0.7982	0.9219	0.9570	(94)
Useful gains	675.5960	766.8443	835.7507	824.8640	695.7878	485.2467	325.2049	340.2264	508.2508	638.5955	640.8564	643.2197	(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	1262.0358	1235.4573	1134.8529	956.6764	736.4217	493.1917	326.6925	342.7585	533.5649	803.5796	1049.1322	1254.2466	(97)
Space heating kWh	436.3112	314.9079	222.5320	94.9049	30.2317	0.0000	0.0000	0.0000	0.0000	122.7482	293.9585	454.6040	(98a)
Space heating requirement - total per year (kWh/year)												1970.1985	
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	436.3112	314.9079	222.5320	94.9049	30.2317	0.0000	0.0000	0.0000	0.0000	122.7482	293.9585	454.6040	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1970.1985	
Space heating per m2											(98c) / (4) =	22.9173	(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 %) 83.7000 (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	436.3112	314.9079	222.5320	94.9049	30.2317	0.0000	0.0000	0.0000	0.0000	122.7482	293.9585	454.6040	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	521.2798	376.2341	265.8686	113.3870	36.1191	0.0000	0.0000	0.0000	0.0000	146.6526	351.2049	543.1350	(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
223.7742 196.8956 206.8771 176.6626 167.6396 147.1493 142.5001 150.4232 154.5554 176.9971 193.8554 220.6676 (64)
Efficiency of water heater 76.4000 (216)
(217)m 84.1094 83.5267 82.3154 80.2910 78.0537 76.4000 76.4000 76.4000 76.4000 80.9997 83.3663 84.2667 (217)
Fuel for water heating, kWh/month
266.0512 235.7278 251.3225 220.0279 214.7747 192.6037 186.5184 196.8890 202.2976 218.5158 232.5344 261.8681 (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 22.5721 18.1082 16.3044 11.9453 9.2269 7.5384 8.4171 10.9408 14.2111 18.6457 21.0603 23.1994 (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 2353.8811 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 76.4000
Water heating fuel used 2679.1312 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 86.0000 (231)
Electricity for lighting (calculated in Appendix L) 182.1696 (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 5301.1819 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2353.8811	3.6400	85.6813	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2679.1312	3.6400	97.5204	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	182.1696	16.4900	30.0398	(250)
Additional standing charges			92.0000	(251)
Total energy cost			319.4228	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8780 (257)
SAP value 85.7676
SAP rating (Section 12) 86 (258)
SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2353.8811	0.2100	494.3150	(261)
Total CO2 associated with community systems			0.0000	(373)

Water heating (other fuel)	2679.1312	0.2100	562.6176 (264)
Space and water heating			1056.9326 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	182.1696	0.1443	26.2927 (268)
Total CO2, kg/year			1095.1545 (272)
CO2 emissions per m2			12.7400 (273)
EI value			88.7951
EI rating			89 (274)
EI band			B

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2896	(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) =	0.2896	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3330	0.3185	0.3185	0.2896	0.2896	0.2534	0.2679	0.2679	0.2679	0.2823	0.2823	0.3113	(22b)
Effective ac	0.5555	0.5507	0.5507	0.5419	0.5419	0.5321	0.5359	0.5359	0.5359	0.5399	0.5399	0.5485	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			74.7000			40.0000	2988.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13303.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		154.7474 (35)

List of Thermal Bridges

		Length	Psi-value	Total
K1	Element			
E2	Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3	Sill	6.7000	0.0400	0.2680
E4	Jamb	47.4200	0.0500	2.3710

E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244	
E16 Corner (normal)	2.5000	0.0900	0.2250	
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250	
E18 Party wall between dwellings	7.5000	0.0600	0.4500	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000	
E14 Flat roof	22.4800	0.0400	0.8992	
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.0690 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	45.6913 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3955	39.0610	39.0610	38.4365	38.4365	37.7395	38.0071	38.0071	38.0071	38.2896	38.2896	38.8993	(38)
Heat transfer coeff	85.0868	84.7523	84.7523	84.1278	84.1278	83.4308	83.6984	83.6984	83.6984	83.9809	83.9809	84.5906	(39)
Average = Sum(39)m / 12 =												84.1605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9897	0.9858	0.9858	0.9786	0.9786	0.9705	0.9736	0.9736	0.9736	0.9769	0.9769	0.9840	(40)
HLP (average)												0.9790	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)

Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	

Distribution loss (46)m = 0.15 x (45)m

33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(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 0.6409	0.5877	0.6477	0.5922	0.5921	0.5481	0.5413	0.5495	0.5409	0.5836	0.5956	0.6352	(61)

Total heat required for water heating calculated for each month

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(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

223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
									Total per year (kWh/year) = Sum(64)m =		2157.9970	(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

74.3520	65.4193	68.7332	58.6915	55.6913	48.8819	47.3366	49.9704	51.3450	58.8034	64.4078	73.3196	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(69)
Pumps, fans	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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)	99.9355	97.3501	92.3833	81.5159	74.8539	67.8915	63.6245	67.1645	71.3126	79.0368	89.4552	98.5478	(72)
Total internal gains	578.4881	576.6043	558.3263	523.7017	489.2022	454.7810	435.9876	438.8260	456.2853	490.7667	529.0227	562.5740	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	724.9470	833.6852	982.4066	1160.1198	1246.4354	1281.5713	1221.4452	1136.1535	997.1508	823.7319	717.5947	680.8179	(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	43.4315	43.6030	43.6030	43.9267	43.9267	44.2936	44.1520	44.1520	44.1520	44.0035	44.0035	43.6863	
alpha	3.8954	3.9069	3.9069	3.9284	3.9284	3.9529	3.9435	3.9435	3.9435	3.9336	3.9336	3.9124	
util living area	0.9546	0.9269	0.8444	0.6860	0.4941	0.2977	0.1780	0.2059	0.4421	0.7568	0.9198	0.9622	(86)
MIT	19.8170	20.0391	20.4610	20.8051	20.9561	20.9957	20.9996	20.9993	20.9792	20.7683	20.2404	19.7606	(87)
Th 2	20.0919	20.0952	20.0952	20.1012	20.1012	20.1080	20.1054	20.1054	20.1054	20.1027	20.1027	20.0967	(88)
util rest of house	0.9460	0.9138	0.8190	0.6447	0.4411	0.2407	0.1168	0.1403	0.3730	0.7094	0.9028	0.9548	(89)
MIT 2	18.7434	19.0195	19.5271	19.9176	20.0678	20.1060	20.1053	20.1053	20.0931	19.8923	19.2793	18.6771	(90)
Living area fraction									fLA = Living area / (4) =			0.4420	(91)
MIT	19.2180	19.4701	19.9399	20.3099	20.4604	20.4992	20.5006	20.5004	20.4848	20.2795	19.7041	19.1560	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2180	19.4701	19.9399	20.3099	20.4604	20.4992	20.5006	20.5004	20.4848	20.2795	19.7041	19.1560	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9357	0.9032	0.8142	0.6547	0.4626	0.2658	0.1439	0.1693	0.4027	0.7194	0.8939	0.9451	(94)
Useful gains	678.3163	753.0053	799.8570	759.5042	576.6213	340.6481	175.7475	192.3980	401.5910	592.5655	641.4629	643.4385	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1175.7269	1158.5758	1028.8826	842.1111	593.9791	342.0033	175.8196	192.5439	408.8492	686.9227	957.7266	1163.6283	(97)
Space heating kWh	370.0735	272.5434	170.3951	59.4770	12.9142	0.0000	0.0000	0.0000	0.0000	70.2017	227.7099	387.0212	(98a)
Space heating requirement - total per year (kWh/year)												1570.3359	
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	370.0735	272.5434	170.3951	59.4770	12.9142	0.0000	0.0000	0.0000	0.0000	70.2017	227.7099	387.0212	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1570.3359	
Space heating per m2											(98c) / (4) =	18.2661	(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 %)	83.7000	(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	370.0735	272.5434	170.3951	59.4770	12.9142	0.0000	0.0000	0.0000	0.0000	70.2017	227.7099	387.0212	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	442.1428	325.6193	203.5783	71.0597	15.4292	0.0000	0.0000	0.0000	0.0000	83.8730	272.0548	462.3909	(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	223.7742	196.8956	206.8771	176.6626	167.6396	147.1493	142.5001	150.4232	154.5554	176.9971	193.8554	220.6676	(64)
Efficiency of water heater												76.4000	(216)
(217)m	83.6267	83.0893	81.5047	79.1650	77.1654	76.4000	76.4000	76.4000	76.4000	79.5320	82.5859	83.8009	(217)
Fuel for water heating, kWh/month	267.5870	236.9685	253.8225	223.1574	217.2472	192.6037	186.5184	196.8890	202.2976	222.5482	234.7317	263.3237	(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	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994	(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	(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	1876.1480	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	76.4000	
Water heating fuel used	2697.6951	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	182.1696	(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	4842.0127	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1876.1480	3.5000	65.6652	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2697.6951	3.5000	94.4193	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154	(249)
Energy for lighting	182.1696	18.3900	33.5010	(250)
Additional standing charges			94.0000	(251)
Total energy cost			303.4009	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1876.1480	0.2100	393.9911	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2697.6951	0.2100	566.5160	(264)
Space and water heating			960.5071	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			998.7290	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1876.1480	1.1300	2120.0473	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2697.6951	1.1300	3048.3955	(278)
Space and water heating			5168.4428	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			5577.9613	(286)

Building Regulations England Part L (BREL) Compliance Report

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

Date: Sun 02 Jul 2023 20:29:43

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/004083	Assessment Date	2023-07-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	86 m^2
Site Reference	Fortess Road	Plot Reference	Flat 3 - Heatpump
Address	Flat 1 7 Fortess Road, LONDON, NW5 1AA		

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	*12.32 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.0 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.47 kWh_{PE}/m^2*	
Dwelling primary energy	31.57 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*34.3 kWh/m^2*	
Dwelling fabric energy efficiency	30.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	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*	1.1	Opening (1.1)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Sheltered wall: Walls (1)	60.32	0.15
Exposed wall: Walls (2)	16.98	0.15
Party wall: Party Wall (1)	7.58	0 **(!)**
Exposed roof: Roof (1)	11.27	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^2K]**
Opening, WINDOWS	12.36	East	0.7	1.1 **(!)**
Opening, WINDOWS	1.98	West	0.7	1.1 **(!)**
Opening, WINDOWS	7.86	West	0.7	1.1 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
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	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	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

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	337.6%
Emitter type	Underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Midea
Model	MHC-V6W/D2N8-B
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 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: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Summary for Input Data

elmhurst energy

Property Reference	Fortess Road	**Issued on Date**	02/07/2023
Assessment Reference	Flat 3 - Heatpump	**Prop Type Ref**	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	87 B	**DER**	3.00	**TER**	12.32
Environmental	97 A	**% DER < TER**			75.65
CO_2 Emissions (t/year)	0.23	**DFEE**	30.83	**TFEE**	34.33
Compliance Check	See BREL	**% DFEE < TFEE**			10.21
% DPER < TPER	51.78	**DPER**	31.57	**TPER**	65.47

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

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

Orientation	East	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	3	
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/m²K
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 m²	0.00 m
Ground floor:	1.00 m	85.97 m²	2.50 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	38.00	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	82.52	60.32	0.50	Stairwell Access Corridor 1	22.20	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	16.98	16.98	0.00	None	0.00	Enter Gross Area

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	Shelter Res	Shelter
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	7.58	0.00	None

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	11.27	0.00	None	0.00	Enter Gross Area	0.00

Summary for Input Data

elmhurst energy

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceiling 1	Precast concrete planks floor, screed, carpeted	30.00	74.70

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	85.97

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	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	WINDOWS	EXTERNAL	East	12.36	0
Opening	WINDOWS	EXTERNAL	West	1.98	0
Opening	WINDOWS	EXTERNAL	West	7.86	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	11.04	0.30	0.30	No
E3 Sill	Independently assessed	6.70	0.04	0.04	No
E4 Jamb	Independently assessed	47.42	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	38.92	0.07	0.07	No
E16 Corner (normal)	Independently assessed	2.50	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.50	-0.09	-0.09	No
E18 Party wall between dwellings	Independently assessed	7.50	0.06	0.06	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	5.69	0.00	0.00	No
E14 Flat roof	Independently assessed	22.48	0.04	0.04	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.37	0.12	0.12	No

Y-value	0.09	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP_{50}	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	11

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	105546	
Fuel Type	Electricity	
SAP Code	0	
In Winter	0.00	
In Summer	0.00	
Model Name	MHC-V6W/D2N8-B	

Summary for Input Data

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	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Enter value
Flow Temperature Value	35.00
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2	None

26.0 Heat Networks	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
Bath Count	1
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	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	2.10	kWh/day
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

None

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 3 - Heatpump	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	87 B	DER	3.00	TER	12.32
Environmental	97 A	% DER < TER			75.65
CO_2 Emissions (t/year)	0.23	DFEE	30.83	TFEE	34.33
Compliance Check	See BREL	% DFEE < TFEE			10.21
% DPER < TPER	51.78	DPER	31.57	TPER	65.47

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700	(1b)	x 2.5000	(2b) =	214.9250	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.9250	(5)

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2896	(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) =	0.2896	(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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)

Party Ceiling 1	74.7000	30.0000	2241.0000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12556.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 146.0583 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.6913 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	85.9883	85.8006	85.6166	84.7523	84.5906	83.8378	83.8378	83.6984	84.1278	84.5906	84.9177	85.2597	(39)

Average = Sum(39)m / 12 = 84.7515

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0002	0.9980	0.9959	0.9858	0.9840	0.9752	0.9752	0.9736	0.9786	0.9840	0.9878	0.9917	(40)
HLP (average)												0.9858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)
Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422

Distribution loss (46)m = 0.15 x (45)m

33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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												
281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)

Total per year (kWh/year) = Sum(64)m = 2838.7482 (64)
12Total per year (kWh/year) 2839 (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

120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(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	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	116.7476	129.2563	116.7476	120.6392	116.7476	120.6392	116.7476	116.7476	120.6392	116.7476	120.6392	116.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	231.4653	233.8671	227.8145	214.9291	198.6635	183.3762	173.1633	170.7615	176.8141	189.6996	205.9651	221.2524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)	162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477	(72)
Total internal gains	572.2431	584.5650	561.0378	541.1886	514.3762	496.0267	477.6636	478.7990	492.8881	509.5980	540.1628	560.6444	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	705.4946	845.2332	990.3212	1167.2729	1281.6659	1281.4843	1225.4513	1121.1376	992.1625	818.9028	706.3118	670.2240	(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	40.5631	40.6519	40.7392	41.1547	41.2333	41.6036	41.6036	41.6729	41.4602	41.2333	41.0745	40.9097	
alpha	3.7042	3.7101	3.7159	3.7436	3.7489	3.7736	3.7736	3.7782	3.7640	3.7489	3.7383	3.7273	
util living area	0.9621	0.9304	0.8668	0.7354	0.5716	0.4094	0.2987	0.3394	0.5501	0.8167	0.9354	0.9677	(86)
Living	19.5339	19.8473	20.2574	20.6751	20.8948	20.9769	20.9946	20.9913	20.9323	20.5898	19.9904	19.4789	
Non living	18.3860	18.7769	19.2780	19.7693	20.0047	20.0883	20.1015	20.1010	20.0505	19.6896	18.9676	18.3219	
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	20.2500	19.8473	20.2574	20.6751	20.8948	20.9769	20.9946	20.9913	20.9323	20.5898	19.9904	19.6917	(87)
Th 2	20.0832	20.0850	20.0868	20.0952	20.0967	20.1041	20.1041	20.1054	20.1012	20.0967	20.0935	20.0902	(88)
util rest of house	0.9554	0.9189	0.8463	0.7009	0.5254	0.3552	0.2389	0.2751	0.4884	0.7818	0.9228	0.9620	(89)
MIT 2	19.4066	18.7769	19.2780	19.7693	20.0047	20.0883	20.1015	20.1010	20.0505	19.6896	18.9676	18.6406	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	19.7794	19.2501	19.7109	20.1697	20.3981	20.4811	20.4962	20.4945	20.4403	20.0875	19.4197	19.1052	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7794	19.2501	19.7109	20.1697	20.3981	20.4811	20.4962	20.4945	20.4403	20.0875	19.4197	19.1052	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9529	0.9064	0.8369	0.7039	0.5412	0.3782	0.2652	0.3033	0.5122	0.7814	0.9114	0.9542	(94)
Useful gains	672.2432	766.1553	828.8078	821.6663	693.6311	484.7144	325.0183	339.9934	508.2324	639.8830	643.7500	639.5573	(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	1331.0445	1231.2429	1131.0748	955.1302	735.7809	493.0545	326.6529	342.7049	533.3924	802.5513	1046.1579	1270.8118	(97)
Space heating kWh	490.1481	312.5388	224.8867	96.0941	31.3595	0.0000	0.0000	0.0000	0.0000	121.0252	289.7336	469.6533	(98a)
Space heating requirement - total per year (kWh/year)												2035.4393	
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	490.1481	312.5388	224.8867	96.0941	31.3595	0.0000	0.0000	0.0000	0.0000	121.0252	289.7336	469.6533	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2035.4393	
Space heating per m2											(98c) / (4) =	23.6762	(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 %)	337.6327	(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	490.1481	312.5388	224.8867	96.0941	31.3595	0.0000	0.0000	0.0000	0.0000	121.0252	289.7336	469.6533	(98)
Space heating efficiency (main heating system 1)	337.6327	337.6327	337.6327	337.6327	337.6327	0.0000	0.0000	0.0000	0.0000	337.6327	337.6327	337.6327	(210)
Space heating fuel (main heating system)	145.1720	92.5677	66.6069	28.4611	9.2880	0.0000	0.0000	0.0000	0.0000	35.8452	85.8133	139.1018	(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

	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488 (64)
Efficiency of water heater												291.2648 (216)
(217)m	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648 (217)
Fuel for water heating, kWh/month												
	96.6645	85.5136	90.8609	79.8594	77.4086	69.7417	68.7949	71.5123	72.2870	80.6242	85.7611	95.5999 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	602.8560 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.2648
Water heating fuel used	974.6280 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	1759.6536 (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	602.8560	0.1567	94.4670	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.6280	0.1409	137.3092	(264)
Space and water heating			231.7763	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			258.0690	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.0000	(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	602.8560	1.5801	952.5499	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.6280	1.5209	1482.3470	(278)
Space and water heating			2434.8969	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			2714.3147	(286)
Dwelling Primary energy Rate (DPER)			31.5700	(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	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3896 (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) =	0.3896 (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	0.4967	0.4870	0.4772	0.4285	0.4188	0.3701	0.3701	0.3604	0.3896	0.4188	0.4383	0.4578	(22b)
Effective ac	0.6234	0.6186	0.6139	0.5918	0.5877	0.5685	0.5685	0.5649	0.5759	0.5877	0.5960	0.6048	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			21.5000	1.1450	24.6183			(27)
EXTERNAL	82.5200	21.5000	61.0200	0.1800	10.9836			(29a)
HALLWAY	16.9800		16.9800	0.1800	3.0564			(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397			(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.8980			(33)
Party Wall 1			7.5800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 154.7474 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.0500	0.5520
E3 Sill	6.7000	0.0500	0.3350
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0800	1.7984
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.2752 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.1732 (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	44.2123	43.8726	43.5395	41.9753	41.6826	40.3202	40.3202	40.0679	40.8450	41.6826	42.2747	42.8936	(38)
Heat transfer coeff	92.3855	92.0458	91.7127	90.1485	89.8558	88.4934	88.4934	88.2411	89.0182	89.8558	90.4479	91.0669	(39)
Average = Sum(39)m / 12 =												90.1471	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0746	1.0707	1.0668	1.0486	1.0452	1.0294	1.0294	1.0264	1.0355	1.0452	1.0521	1.0593	(40)
HLP (average)												1.0486	

Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5664	(42)
Hot water usage for mixer showers													
	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)
Hot water usage for baths													
	29.0432	28.6119	28.0044	26.8845	26.0459	25.1160	24.6137	25.2169	25.8736	26.8686	28.0116	28.9450	(42b)
Hot water usage for other uses													
	40.9130	39.4252	37.9375	36.4497	34.9620	33.4743	33.4743	34.9620	36.4497	37.9375	39.4252	40.9130	(42c)
Average daily hot water use (litres/day)												126.1240	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.2068	134.2771	130.7092	125.2837	120.8779	116.1414	114.3210	117.8734	121.6201	126.5927	132.1017	136.8509	(44)
Energy conte	217.3020	191.2087	200.8952	171.5072	162.7250	142.8093	138.2613	145.9519	149.9697	171.7851	188.2031	214.2755	(45)
Energy content (annual)											Total = Sum(45)m =	2094.8940	
Distribution loss (46)m = 0.15 x (45)m													
	32.5953	28.6813	30.1343	25.7261	24.4087	21.4214	20.7392	21.8928	22.4955	25.7678	28.2305	32.1413	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	268.2281	237.2065	251.8212	220.7905	213.6510	192.0926	189.1874	196.8780	199.2530	222.7111	237.4864	265.2015	(62)
WWHRS	-30.7442	-27.1904	-28.4722	-23.5761	-21.9721	-18.8017	-17.6236	-18.7409	-19.4529	-22.9329	-25.9802	-30.1748	(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													
	237.4839	210.0161	223.3490	197.2143	191.6789	173.2910	171.5638	178.1371	179.8001	199.7783	211.5063	235.0267	(64)
										Total per year (kWh/year) = Sum(64)m =		2408.8455	(64)
12Total per year (kWh/year)												2409	(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													
	112.9938	100.3751	107.5385	96.4528	94.8469	86.9107	86.7127	89.2699	89.2916	97.8594	102.0042	111.9875	(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	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	128.3223	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	116.7476	129.2563	116.7476	120.6392	116.7476	120.6392	116.7476	116.7476	120.6392	116.7476	120.6392	116.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	231.4653	233.8671	227.8145	214.9291	198.6635	183.3762	173.1633	170.7615	176.8141	189.6996	205.9651	221.2524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	35.8322	(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)													
	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)													
	151.8733	149.3677	144.5410	133.9622	127.4824	120.7094	116.5494	119.9864	124.0161	131.5314	141.6725	150.5208	(72)
Total internal gains													
	564.5830	576.9879	553.5998	534.0272	507.3903	486.2215	467.9571	468.9922	482.9661	502.4753	532.7735	553.0175	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.9700	19.6403	0.6300	0.7000	0.7700	71.8478	(76)
West	9.5300	19.6403	0.6300	0.7000	0.7700	57.2021	(80)
Solar gains	129.0499	252.4489	415.7474	606.3429	743.0959	760.6909	724.2088	622.0846	483.5315	299.5519	160.9100	106.1243	(83)
Total gains	693.6328	829.4368	969.3473	1140.3700	1250.4862	1246.9124	1192.1659	1091.0768	966.4976	802.0273	693.6835	659.1419	(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	40.0003	40.1480	40.2938	40.9930	41.1265	41.7596	41.7596	41.8790	41.5135	41.1265	40.8573	40.5796	
alpha	3.6667	3.6765	3.6863	3.7329	3.7418	3.7840	3.7840	3.7919	3.7676	3.7418	3.7238	3.7053	
util living area	0.9699	0.9442	0.8906	0.7708	0.6107	0.4414	0.3234	0.3665	0.5881	0.8448	0.9479	0.9744	(86)
MIT	19.4164	19.7267	20.1491	20.6119	20.8679	20.9706	20.9930	20.9888	20.9157	20.5287	19.9019	19.3777	(87)
Th 2	20.0216	20.0249	20.0280	20.0430	20.0458	20.0589	20.0589	20.0614	20.0539	20.0458	20.0402	20.0342	(88)
util rest of house	0.9641	0.9339	0.8715	0.7361	0.5608	0.3808	0.2556	0.2940	0.5211	0.8109	0.9366	0.9694	(89)
MIT 2	18.1912	18.5810	19.1015	19.6547	19.9314	20.0394	20.0558	20.0560	19.9916	19.5787	18.8166	18.1510	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	18.7327	19.0874	19.5646	20.0778	20.3454	20.4510	20.4700	20.4683	20.4000	19.9986	19.2963	18.6932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7327	19.0874	19.5646	20.0778	20.3454	20.4510	20.4700	20.4683	20.4000	19.9986	19.2963	18.6932	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9541	0.9219	0.8611	0.7374	0.5770	0.4064	0.2854	0.3258	0.5464	0.8090	0.9257	0.9603	(94)
Useful gains	661.8226	764.6420	834.7280	840.9379	721.4886	506.7253	340.2915	355.4205	528.0897	648.8246	642.1629	632.9589	(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	1333.3753	1305.8934	1198.1893	1007.6602	776.8358	517.7743	342.4735	358.9956	560.8184	844.5205	1103.1334	1319.8547	(97)
Space heating kWh	499.6352	363.7210	270.4152	120.0400	41.1783	0.0000	0.0000	0.0000	0.0000	145.5978	331.8988	511.0505	(98a)
Space heating requirement - total per year (kWh/year)												2283.5368	
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	499.6352	363.7210	270.4152	120.0400	41.1783	0.0000	0.0000	0.0000	0.0000	145.5978	331.8988	511.0505	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2283.5368	
Space heating per m2											(98c) / (4) =	26.5620	(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	499.6352	363.7210	270.4152	120.0400	41.1783	0.0000	0.0000	0.0000	0.0000	145.5978	331.8988	511.0505	(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)	541.3166	394.0639	292.9743	130.0542	44.6135	0.0000	0.0000	0.0000	0.0000	157.7440	359.5870	553.6842	(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	237.4839	210.0161	223.3490	197.2143	191.6789	173.2910	171.5638	178.1371	179.8001	199.7783	211.5063	235.0267	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6865	85.2793	84.4897	82.9822	81.2563	79.8000	79.8000	79.8000	79.8000	83.3617	85.0658	85.7533	(217)
Fuel for water heating, kWh/month	277.1544	246.2684	264.3506	237.6585	235.8941	217.1566	214.9922	223.2295	225.3133	239.6523	248.6383	274.0730	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.2579	19.4606	17.5221	12.8374	9.9160	8.1015	9.0457	11.7579	15.2724	20.0382	22.6331	24.9321	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.9049	-28.2721	-43.0757	-51.4271	-58.0976	-55.1887	-54.5046	-50.1294	-42.9016	-33.6087	-21.3471	-16.1603	(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	-6.2705	-13.5272	-27.5296	-42.3151	-56.9190	-57.5581	-56.8934	-47.7351	-34.4127	-19.6699	-8.4734	-4.9347	(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												2474.0377	(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	2904.3812 (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)	195.7748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-849.8565 (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	4810.3372 (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	2474.0377	0.2100	519.5479	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2904.3812	0.2100	609.9201	(264)
Space and water heating			1129.4680	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	195.7748	0.1443	28.2564	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.6177	0.1334	-63.1680	
PV Unit electricity exported	-376.2388	0.1252	-47.1123	
Total			-110.2804	(269)
Total CO2, kg/year			1059.3732	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			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	2474.0377	1.1300	2795.6626	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.3812	1.1300	3281.9508	(278)
Space and water heating			6077.6134	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	195.7748	1.5338	300.2859	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-473.6177	1.4929	-707.0434	
PV Unit electricity exported	-376.2388	0.4596	-172.9222	
Total			-879.9656	(283)
Total Primary energy kWh/year			5628.0345	(286)
Target Primary Energy Rate (TPER)			65.4700	(287)

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 3 - Heatpump	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	87 B	DER	3.00	TER	12.32
Environmental	97 A	% DER < TER			75.65
CO_2 Emissions (t/year)	0.23	DFEE	30.83	TFEE	34.33
Compliance Check	See BREL	% DFEE < TFEE			10.21
% DPER < TPER	51.78	DPER	31.57	TPER	65.47

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 ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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) =	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)

Party Ceiling 1	74.7000	40.0000	2988.0000 (32b)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13303.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 154.7474 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.6913 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	85.9883	85.8006	85.6166	84.7523	84.5906	83.8378	83.8378	83.6984	84.1278	84.5906	84.9177	85.2597	(39)

Average = Sum(39)m / 12 = 84.7515

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0002	0.9980	0.9959	0.9858	0.9840	0.9752	0.9752	0.9736	0.9786	0.9840	0.9878	0.9917	(40)
HLP (average)												0.9858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5664 (42)
Hot water usage for mixer showers

67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day) 129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)

Energy content (annual) Total = Sum(45)m = 2150.9422

Distribution loss (46)m = 0.15 x (45)m												
33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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

281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)

Total per year (kWh/year) = Sum(64)m = 2838.7482 (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

120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)

-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)

Water heating gains (Table 5)

162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477 (72)

Total internal gains

638.0861	636.1990	617.9220	583.3094	548.8165	517.4040	498.6190	501.4547	518.9108	550.3840	588.6292	622.1739 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	771.3376	896.8672	1047.2054	1209.3936	1316.1063	1302.8616	1246.4067	1143.7933	1018.1851	859.6888	754.7782	731.7535	(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	42.9762	43.0703	43.1628	43.6030	43.6863	44.0786	44.0786	44.1520	43.9267	43.6863	43.5180	43.3435	
alpha	3.8651	3.8714	3.8775	3.9069	3.9124	3.9386	3.9386	3.9435	3.9284	3.9124	3.9012	3.8896	
util living area	0.9560	0.9250	0.8566	0.7260	0.5628	0.4044	0.2942	0.3335	0.5414	0.8055	0.9291	0.9627	(86)
Living	19.7027	19.9747	20.3597	20.7250	20.9143	20.9818	20.9960	20.9934	20.9453	20.6508	20.1073	19.6453	
Non living	18.5919	18.9296	19.3965	19.8229	20.0231	20.0920	20.1022	20.1022	20.0612	19.7555	19.1066	18.5253	
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	20.3364	19.9747	20.3597	20.7250	20.9143	20.9818	20.9960	20.9934	20.9453	20.6508	20.1073	19.8348	(87)
Th 2	20.0832	20.0850	20.0868	20.0952	20.0967	20.1041	20.1041	20.1054	20.1012	20.0967	20.0935	20.0902	(88)
util rest of house	0.9481	0.9124	0.8345	0.6904	0.5163	0.3503	0.2351	0.2700	0.4794	0.7686	0.9149	0.9559	(89)
MIT 2	19.4886	18.9296	19.3965	19.8229	20.0231	20.0920	20.1022	20.1022	20.0612	19.7555	19.1066	18.8073	(90)
Living area fraction									fLA = Living area / (4) =			0.4420	(91)
MIT	19.8633	19.3916	19.8222	20.2216	20.4170	20.4853	20.4973	20.4962	20.4520	20.1512	19.5490	19.2615	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8633	19.3916	19.8222	20.2216	20.4170	20.4853	20.4973	20.4962	20.4520	20.1512	19.5490	19.2615	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9459	0.9012	0.8275	0.6956	0.5332	0.3735	0.2612	0.2979	0.5042	0.7710	0.9049	0.9484	(94)
Useful gains	729.6362	808.2576	866.5326	841.2835	701.6940	486.6632	325.5018	340.7632	513.3252	662.8208	683.0135	694.0243	(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	1338.2649	1243.3859	1140.6046	959.5333	737.3798	493.4125	326.7396	342.8431	534.3783	807.9421	1057.1369	1284.1351	(97)
Space heating kWh	452.8197	292.4062	203.9096	85.1398	26.5503	0.0000	0.0000	0.0000	0.0000	107.9703	269.3688	439.0424	(98a)
Space heating requirement - total per year (kWh/year)												1877.2071	
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	452.8197	292.4062	203.9096	85.1398	26.5503	0.0000	0.0000	0.0000	0.0000	107.9703	269.3688	439.0424	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1877.2071	
Space heating per m2										(98c) / (4) =		21.8356	(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 %) 337.6327 (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	452.8197	292.4062	203.9096	85.1398	26.5503	0.0000	0.0000	0.0000	0.0000	107.9703	269.3688	439.0424	(98)
Space heating efficiency (main heating system 1)	337.6327	337.6327	337.6327	337.6327	337.6327	0.0000	0.0000	0.0000	0.0000	337.6327	337.6327	337.6327	(210)
Space heating fuel (main heating system)	134.1161	86.6048	60.3939	25.2167	7.8637	0.0000	0.0000	0.0000	0.0000	31.9786	79.7816	130.0355	(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												
	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488 (64)
Efficiency of water heater												291.2648 (216)
(217)m	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648 (217)
Fuel for water heating, kWh/month												
	96.6645	85.5136	90.8609	79.8594	77.4086	69.7417	68.7949	71.5123	72.2870	80.6242	85.7611	95.5999 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	555.9909 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.2648
Water heating fuel used	974.6280 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	1712.7884 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	555.9909	16.4900	91.6829	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.6280	16.4900	160.7162	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	182.1696	16.4900	30.0398	(250)
Additional standing charges			0.0000	(251)
Total energy cost			282.4388	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7763 (257)
SAP value		87.4154
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	555.9909	0.1568	87.1939	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.6280	0.1409	137.3092	(264)
Space and water heating			224.5031	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)

Total CO2, kg/year	250.7958 (272)
CO2 emissions per m2	2.9200 (273)
EI value	97.4340
EI rating	97 (274)
EI band	A

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 85.9700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2896	(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) =	0.2896	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3330	0.3185	0.3185	0.2896	0.2896	0.2534	0.2679	0.2679	0.2679	0.2823	0.2823	0.3113	(22b)
Effective ac	0.5555	0.5507	0.5507	0.5419	0.5419	0.5321	0.5359	0.5359	0.5359	0.5399	0.5399	0.5485	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			74.7000			40.0000	2988.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13303.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		154.7474 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500

P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000		
E14 Flat roof	22.4800	0.0400	0.8992		
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.0690	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	45.6913	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3955	39.0610	39.0610	38.4365	38.4365	37.7395	38.0071	38.0071	38.0071	38.2896	38.2896	38.8993	(38)
Heat transfer coeff	85.0868	84.7523	84.7523	84.1278	84.1278	83.4308	83.6984	83.6984	83.6984	83.9809	83.9809	84.5906	(39)
Average = Sum(39)m / 12 =												84.1605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9897	0.9858	0.9858	0.9786	0.9786	0.9705	0.9736	0.9736	0.9736	0.9769	0.9769	0.9840	(40)
HLP (average)												0.9790	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5664	(42)
Hot water usage for mixer showers	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)
Hot water usage for baths	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)
Hot water usage for other uses	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)
Average daily hot water use (litres/day)												129.4988	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
										Total per year (kWh/year) = Sum(64)m =		2838.7482	(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	120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)
Water heating gains (Table 5)	162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477	(72)
Total internal gains	638.0861	636.1990	617.9220	583.3094	548.8165	517.4040	498.6190	501.4547	518.9108	550.3840	588.6292	622.1739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420 (76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	784.5450	893.2799	1042.0023	1219.7275	1306.0498	1344.1943	1284.0766	1198.7822	1059.7763	883.3491	777.2013	740.4178	(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	43.4315	43.6030	43.6030	43.9267	43.9267	44.2936	44.1520	44.1520	44.1520	44.0035	44.0035	43.6863	
alpha	3.8954	3.9069	3.9069	3.9284	3.9284	3.9529	3.9435	3.9435	3.9435	3.9336	3.9336	3.9124	
util living area	0.9429	0.9121	0.8235	0.6625	0.4740	0.2841	0.1693	0.1952	0.4179	0.7259	0.9011	0.9514	(86)
Living	19.9058	20.1173	20.5141	20.8280	20.9620	20.9964	20.9997	20.9994	20.9829	20.8016	20.3157	19.8526	
Non living	18.8528	19.1139	19.5871	19.9403	20.0725	20.1063	20.1054	20.1053	20.0954	19.9250	19.3683	18.7910	
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	20.4403	20.1173	20.5141	20.8280	20.9620	20.9964	20.9997	20.9994	20.9829	20.8016	20.3157	20.0131	(87)
Th 2	20.0919	20.0952	20.0952	20.1012	20.1012	20.1080	20.1054	20.1054	20.1054	20.1027	20.1027	20.0967	(88)
util rest of house	0.9324	0.8971	0.7962	0.6210	0.4225	0.2296	0.1111	0.1330	0.3519	0.6770	0.8813	0.9422	(89)
MIT 2	19.5979	19.1139	19.5871	19.9403	20.0725	20.1063	20.1054	20.1053	20.0954	19.9250	19.3683	19.0263	(90)
Living area fraction										fLA = Living area / (4) =		0.4420	(91)
MIT	19.9702	19.5574	19.9969	20.3327	20.4657	20.4997	20.5007	20.5005	20.4877	20.3125	19.7871	19.4625	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9702	19.5574	19.9969	20.3327	20.4657	20.4997	20.5007	20.5005	20.4877	20.3125	19.7871	19.4625	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8868	0.7930	0.6320	0.4436	0.2536	0.1369	0.1605	0.3804	0.6891	0.8733	0.9346	(94)
Useful gains	730.3069	792.1318	826.3197	770.9183	579.4061	340.9017	175.7628	192.4304	403.1551	608.6765	678.7452	691.9592	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1239.7363	1165.9734	1033.7113	844.0277	594.4184	342.0433	175.8225	192.5497	409.0944	689.6927	964.6949	1189.5557	(97)
Space heating kWh	379.0155	251.2216	154.2994	52.6388	11.1691	0.0000	0.0000	0.0000	0.0000	60.2761	205.8838	370.2118	(98a)
Space heating requirement - total per year (kWh/year)												1484.7161	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	379.0155	251.2216	154.2994	52.6388	11.1691	0.0000	0.0000	0.0000	0.0000	60.2761	205.8838	370.2118	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1484.7161	
Space heating per m2											(98c) / (4) =	17.2702	(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 %)	337.5245 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	379.0155	251.2216	154.2994	52.6388	11.1691	0.0000	0.0000	0.0000	0.0000	60.2761	205.8838	370.2118	(98)
Space heating efficiency (main heating system 1)	337.5245	337.5245	337.5245	337.5245	337.5245	0.0000	0.0000	0.0000	0.0000	337.5245	337.5245	337.5245	(210)
Space heating fuel (main heating system)	112.2928	74.4306	45.7150	15.5955	3.3091	0.0000	0.0000	0.0000	0.0000	17.8583	60.9982	109.6844	(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	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
Efficiency of water heater												291.2939	(216)
(217)m	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	(217)
Fuel for water heating, kWh/month	96.6548	85.5051	90.8518	79.8514	77.4008	69.7348	68.7880	71.5051	72.2797	80.6162	85.7525	95.5903	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994 (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	439.8840 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.2939
Water heating fuel used	974.5305 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	1596.5841 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	439.8840	18.3900	80.8947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.5305	18.3900	179.2162	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	182.1696	18.3900	33.5010	(250)
Additional standing charges			0.0000	(251)
Total energy cost			293.6118	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	439.8840	0.1578	69.3920	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.5305	0.1409	137.2955	(264)
Space and water heating			206.6875	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			232.9802	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	439.8840	1.5839	696.7519	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.5305	1.5209	1482.1988	(278)
Space and water heating			2178.9507	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			2458.3684	(286)

SAP 10 EPC IMPROVEMENTS

Flat 3 - Heatpump

Current energy efficiency rating: B 87
Current environmental impact rating: A 97

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

Recommended measures: SAP change Cost change CO2 change
(none)

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

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£294	£294	£0
Space heating	£81	£81	£0
Water heating	£179	£179	£0
Lighting	£34	£34	£0
Total cost of fuels	£294	£294	£0
Total cost of uses	£294	£294	£0
Delivered energy	19 kWh/m²	19 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	29 kWh/m²	29 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2896 (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)	=	0.2896 (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	0.3692	0.3620	0.3547	0.3185	0.3113	0.2751	0.2751	0.2679	0.2896	0.3113	0.3258	0.3403	(22b)
Effective ac	0.5682	0.5655	0.5629	0.5507	0.5485	0.5378	0.5378	0.5359	0.5419	0.5485	0.5531	0.5579	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			74.7000			40.0000	2988.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13303.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		154.7474 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3	Sill	6.7000	0.0400	0.2680
E4	Jamb	47.4200	0.0500	2.3710
E7	Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16	Corner (normal)	2.5000	0.0900	0.2250
E17	Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18	Party wall between dwellings	7.5000	0.0600	0.4500
P3	Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14	Flat roof	22.4800	0.0400	0.8992
P4	Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0690 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	45.6913 (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	40.2970	40.1093	39.9253	39.0610	38.8993	38.1465	38.1465	38.0071	38.4365	38.8993	39.2264	39.5684	(38)
Heat transfer coeff	85.9883	85.8006	85.6166	84.7523	84.5906	83.8378	83.8378	83.6984	84.1278	84.5906	84.9177	85.2597	(39)
Average = Sum(39)m / 12 =												84.7515	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0002	0.9980	0.9959	0.9858	0.9840	0.9752	0.9752	0.9736	0.9786	0.9840	0.9878	0.9917	(40)
HLP (average)												0.9858	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5664	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)

Hot water usage for baths

30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)

Hot water usage for other uses

43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)

Average daily hot water use (litres/day)	129.4988 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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

	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488 (64)
Total per year (kWh/year) = Sum(64)m =												2838.7482 (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

	120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939 (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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)

	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)

Water heating gains (Table 5)

	162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477	(72)

Total internal gains

	638.0861	636.1990	617.9220	583.3094	548.8165	517.4040	498.6190	501.4547	518.9108	550.3840	588.6292	622.1739	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	19.6403	0.6300	0.7000	0.7700	74.1887	(76)
West	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(80)

Solar gains	133.2515	260.6682	429.2834	626.0843	767.2898	785.4576	747.7877	642.3385	499.2744	309.3048	166.1490	109.5796	(83)
Total gains	771.3376	896.8672	1047.2054	1209.3936	1316.1063	1302.8616	1246.4067	1143.7933	1018.1851	859.6888	754.7782	731.7535	(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	42.9762	43.0703	43.1628	43.6030	43.6863	44.0786	44.0786	44.1520	43.9267	43.6863	43.5180	43.3435	
alpha	3.8651	3.8714	3.8775	3.9069	3.9124	3.9386	3.9386	3.9435	3.9284	3.9124	3.9012	3.8896	
util living area	0.9560	0.9250	0.8566	0.7260	0.5628	0.4044	0.2942	0.3335	0.5414	0.8055	0.9291	0.9627	(86)
Living	19.7027	19.9747	20.3597	20.7250	20.9143	20.9818	20.9960	20.9934	20.9453	20.6508	20.1073	19.6453	
Non living	18.5919	18.9296	19.3965	19.8229	20.0231	20.0920	20.1022	20.1022	20.0612	19.7555	19.1066	18.5253	
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	20.3364	19.9747	20.3597	20.7250	20.9143	20.9818	20.9960	20.9934	20.9453	20.6508	20.1073	19.8348	(87)
Th 2	20.0832	20.0850	20.0868	20.0952	20.0967	20.1041	20.1041	20.1054	20.1012	20.0967	20.0935	20.0902	(88)
util rest of house	0.9481	0.9124	0.8345	0.6904	0.5163	0.3503	0.2351	0.2700	0.4794	0.7686	0.9149	0.9559	(89)
MIT 2	19.4886	18.9296	19.3965	19.8229	20.0231	20.0920	20.1022	20.1022	20.0612	19.7555	19.1066	18.8073	(90)
Living area fraction									fLA = Living area / (4) =			0.4420	(91)
MIT	19.8633	19.3916	19.8222	20.2216	20.4170	20.4853	20.4973	20.4962	20.4520	20.1512	19.5490	19.2615	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8633	19.3916	19.8222	20.2216	20.4170	20.4853	20.4973	20.4962	20.4520	20.1512	19.5490	19.2615	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9459	0.9012	0.8275	0.6956	0.5332	0.3735	0.2612	0.2979	0.5042	0.7710	0.9049	0.9484	(94)
Useful gains	729.6362	808.2576	866.5326	841.2835	701.6940	486.6632	325.5018	340.7632	513.3252	662.8208	683.0135	694.0243	(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	1338.2649	1243.3859	1140.6046	959.5333	737.3798	493.4125	326.7396	342.8431	534.3783	807.9421	1057.1369	1284.1351	(97)
Space heating kWh	452.8197	292.4062	203.9096	85.1398	26.5503	0.0000	0.0000	0.0000	0.0000	107.9703	269.3688	439.0424	(98a)
Space heating requirement - total per year (kWh/year)												1877.2071	
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													

	452.8197	292.4062	203.9096	85.1398	26.5503	0.0000	0.0000	0.0000	0.0000	107.9703	269.3688	439.0424 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1877.2071
Space heating per m2											(98c) / (4) =	21.8356 (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 %)	337.6327 (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													
	452.8197	292.4062	203.9096	85.1398	26.5503	0.0000	0.0000	0.0000	0.0000	107.9703	269.3688	439.0424	(98)
Space heating efficiency (main heating system 1)													
	337.6327	337.6327	337.6327	337.6327	337.6327	0.0000	0.0000	0.0000	0.0000	337.6327	337.6327	337.6327	(210)
Space heating fuel (main heating system)													
	134.1161	86.6048	60.3939	25.2167	7.8637	0.0000	0.0000	0.0000	0.0000	31.9786	79.7816	130.0355	(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													
	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
Efficiency of water heater												291.2648	(216)
(217)m	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	291.2648	(217)
Fuel for water heating, kWh/month													
	96.6645	85.5136	90.8609	79.8594	77.4086	69.7417	68.7949	71.5123	72.2870	80.6242	85.7611	95.5999	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994	(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	555.9909 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	291.2648
Water heating fuel used	974.6280 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	182.1696 (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	1712.7884 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	555.9909	16.4900	91.6829	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.6280	16.4900	160.7162	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	182.1696	16.4900	30.0398	(250)
Additional standing charges			0.0000	(251)
Total energy cost			282.4388	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =		0.7763 (257)
SAP value			87.4154
SAP rating (Section 12)			87 (258)
SAP band			B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	555.9909	0.1568	87.1939	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.6280	0.1409	137.3092	(264)
Space and water heating			224.5031	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)
Total CO2, kg/year			250.7958	(272)
CO2 emissions per m2			2.9200	(273)
EI value			97.4340	
EI rating			97	(274)
EI band			A	

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		85.9700 (1b)	x	2.5000 (2b)	=	214.9250 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.9700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.9250	(5)

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2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2896	(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) =	0.2896	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3330	0.3185	0.3185	0.2896	0.2896	0.2534	0.2679	0.2679	0.2679	0.2823	0.2823	0.3113	(22b)
Effective ac	0.5555	0.5507	0.5507	0.5419	0.5419	0.5321	0.5359	0.5359	0.5359	0.5399	0.5399	0.5485	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			22.2000	1.0536	23.3908			(27)
EXTERNAL	82.5200	22.2000	60.3200	0.1400	8.4448	70.0000	4222.4000	(29a)
HALLWAY	16.9800		16.9800	0.1500	2.5470	70.0000	1188.6000	(29a)
Flat Roof	11.2700		11.2700	0.1100	1.2397	9.0000	101.4300	(30)
Total net area of external elements Aum(A, m2)			110.7700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.6223			(33)
Party Wall 1			7.5800	0.0000	0.0000	180.0000	1364.4000	(32)
Party Floor 1			85.9700			40.0000	3438.8000	(32d)
Party Ceiling 1			74.7000			40.0000	2988.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13303.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		154.7474 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0690 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	45.6913 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3955	39.0610	39.0610	38.4365	38.4365	37.7395	38.0071	38.0071	38.0071	38.2896	38.2896	38.8993	(38)
Heat transfer coeff	85.0868	84.7523	84.7523	84.1278	84.1278	83.4308	83.6984	83.6984	83.6984	83.9809	83.9809	84.5906	(39)
Average = Sum(39)m / 12 =												84.1605	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9897	0.9858	0.9858	0.9786	0.9786	0.9705	0.9736	0.9736	0.9736	0.9769	0.9769	0.9840	(40)
HLP (average)												0.9790	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5664 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.2506	66.2400	64.7673	61.9495	59.8701	57.5511	56.2330	57.6945	59.2967	61.7866	64.6648	66.9929	(42a)
Hot water usage for baths	30.5718	30.1177	29.4784	28.2995	27.4167	26.4379	25.9092	26.5441	27.2354	28.2828	29.4859	30.4684	(42b)
Hot water usage for other uses	43.0663	41.5002	39.9342	38.3682	36.8021	35.2361	35.2361	36.8021	38.3682	39.9342	41.5002	43.0663	(42c)
Average daily hot water use (litres/day)												129.4988	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.8887	137.8580	134.1798	128.6171	124.0889	119.2251	117.3782	121.0408	124.9002	130.0035	135.6510	140.5277	(44)
Energy conte	223.1332	196.3079	206.2294	176.0704	167.0475	146.6011	141.9588	149.8737	154.0145	176.4136	193.2598	220.0324	(45)
Energy content (annual)										Total = Sum(45)m =		2150.9422	
Distribution loss (46)m = 0.15 x (45)m	33.4700	29.4462	30.9344	26.4106	25.0571	21.9902	21.2938	22.4811	23.1022	26.4620	28.9890	33.0049	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(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	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
										Total per year (kWh/year) = Sum(64)m =		2838.7482	(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	120.9249	107.4829	115.3044	103.7690	102.2764	93.9705	93.9344	96.5661	96.4354	105.3906	109.4845	119.8939	(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	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	153.9868	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.7880	22.9047	18.6273	14.1021	10.5415	8.8996	9.6163	12.4996	16.7769	21.3022	24.8628	26.5047	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	345.4705	349.0554	340.0216	320.7896	296.5127	273.6958	258.4528	254.8679	263.9017	283.1337	307.4106	330.2275	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	52.9651	(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)

	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	-102.6579	(71)

Water heating gains (Table 5)

	162.5335	159.9448	154.9790	144.1236	137.4683	130.5145	126.2559	129.7932	133.9381	141.6541	152.0618	161.1477	(72)

Total internal gains

	638.0861	636.1990	617.9220	583.3094	548.8165	517.4040	498.6190	501.4547	518.9108	550.3840	588.6292	622.1739	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.3600	21.5869	0.6300	0.7000	0.7700	81.5420	(76)
West	9.8400	21.5869	0.6300	0.7000	0.7700	64.9169	(80)

Solar gains	146.4589	257.0809	424.0803	636.4181	757.2332	826.7903	785.4576	697.3275	540.8656	332.9651	188.5721	118.2439	(83)
Total gains	784.5450	893.2799	1042.0023	1219.7275	1306.0498	1344.1943	1284.0766	1198.7822	1059.7763	883.3491	777.2013	740.4178	(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	43.4315	43.6030	43.6030	43.9267	43.9267	44.2936	44.1520	44.1520	44.1520	44.0035	44.0035	43.6863	
alpha	3.8954	3.9069	3.9069	3.9284	3.9284	3.9529	3.9435	3.9435	3.9435	3.9336	3.9336	3.9124	
util living area													
	0.9429	0.9121	0.8235	0.6625	0.4740	0.2841	0.1693	0.1952	0.4179	0.7259	0.9011	0.9514	(86)
Living	19.9058	20.1173	20.5141	20.8280	20.9620	20.9964	20.9997	20.9994	20.9829	20.8016	20.3157	19.8526	
Non living	18.8528	19.1139	19.5871	19.9403	20.0725	20.1063	20.1054	20.1053	20.0954	19.9250	19.3683	18.7910	
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	20.4403	20.1173	20.5141	20.8280	20.9620	20.9964	20.9997	20.9994	20.9829	20.8016	20.3157	20.0131	(87)
Th 2	20.0919	20.0952	20.0952	20.1012	20.1012	20.1080	20.1054	20.1054	20.1054	20.1027	20.1027	20.0967	(88)
util rest of house													
	0.9324	0.8971	0.7962	0.6210	0.4225	0.2296	0.1111	0.1330	0.3519	0.6770	0.8813	0.9422	(89)
MIT 2	19.5979	19.1139	19.5871	19.9403	20.0725	20.1063	20.1054	20.1053	20.0954	19.9250	19.3683	19.0263	(90)
Living area fraction									fLA = Living area / (4) =			0.4420	(91)
MIT	19.9702	19.5574	19.9969	20.3327	20.4657	20.4997	20.5007	20.5005	20.4877	20.3125	19.7871	19.4625	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9702	19.5574	19.9969	20.3327	20.4657	20.4997	20.5007	20.5005	20.4877	20.3125	19.7871	19.4625	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9309	0.8868	0.7930	0.6320	0.4436	0.2536	0.1369	0.1605	0.3804	0.6891	0.8733	0.9346	(94)
Useful gains	730.3069	792.1318	826.3197	770.9183	579.4061	340.9017	175.7628	192.4304	403.1551	608.6765	678.7452	691.9592	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W													
	1239.7363	1165.9734	1033.7113	844.0277	594.4184	342.0433	175.8225	192.5497	409.0944	689.6927	964.6949	1189.5557	(97)
Space heating kWh													
	379.0155	251.2216	154.2994	52.6388	11.1691	0.0000	0.0000	0.0000	0.0000	60.2761	205.8838	370.2118	(98a)
Space heating requirement - total per year (kWh/year)												1484.7161	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	379.0155	251.2216	154.2994	52.6388	11.1691	0.0000	0.0000	0.0000	0.0000	60.2761	205.8838	370.2118	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1484.7161	
Space heating per m2											(98c) / (4) =	17.2702	(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 %)	337.5245	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	379.0155	251.2216	154.2994	52.6388	11.1691	0.0000	0.0000	0.0000	0.0000	60.2761	205.8838	370.2118	(98)
Space heating efficiency (main heating system 1)													
	337.5245	337.5245	337.5245	337.5245	337.5245	0.0000	0.0000	0.0000	0.0000	337.5245	337.5245	337.5245	(210)
Space heating fuel (main heating system)													
	112.2928	74.4306	45.7150	15.5955	3.3091	0.0000	0.0000	0.0000	0.0000	17.8583	60.9982	109.6844	(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													
	281.5496	249.0711	264.6458	232.6024	225.4639	203.1331	200.3752	208.2901	210.5465	234.8300	249.7918	278.4488	(64)
Efficiency of water heater												291.2939	(216)
(217)m	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	291.2939	(217)
Fuel for water heating, kWh/month													
	96.6548	85.5051	90.8518	79.8514	77.4008	69.7348	68.7880	71.5051	72.2797	80.6162	85.7525	95.5903	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	22.5721	18.1082	16.3044	11.9453	9.2269	7.5384	8.4171	10.9408	14.2111	18.6457	21.0603	23.1994	(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	439.8840	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	291.2939	
Water heating fuel used	974.5305	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	182.1696	(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	1596.5841	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	439.8840	18.3900	80.8947	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.5305	18.3900	179.2162	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	182.1696	18.3900	33.5010	(250)
Additional standing charges			0.0000	(251)
Total energy cost			293.6118	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	439.8840	0.1578	69.3920	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	974.5305	0.1409	137.2955	(264)
Space and water heating			206.6875	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	182.1696	0.1443	26.2927	(268)

Total CO2, kg/year	232.9802 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	439.8840	1.5839	696.7519	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	974.5305	1.5209	1482.1988	(278)
Space and water heating			2178.9507	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	182.1696	1.5338	279.4177	(282)
Total Primary energy kWh/year			2458.3684	(286)

Building Regulations England Part L (BREL) Compliance Report

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

Date: Sun 02 Jul 2023 20:29:42

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/004083	Assessment Date	2023-07-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	70 m^2
Site Reference	Fortess Road	Plot Reference	Flat 4 - Boiler
Address	Flat 1 7 Fortess Road, LONDON, NW5 1AA		

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	*15.11 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	16.43 $kgCO_2/m^2$	**FAIL**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*80.61 kWh_{PE}/m^2*	
Dwelling primary energy	91.01 kWh_{PE}/m^2	**FAIL**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*41.1 kWh/m^2*	
Dwelling fabric energy efficiency	42.7 kWh/m^2	**FAIL**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	**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*	1.1	Opening (1.1)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	55.89	0.15
Sheltered wall: Walls (2)	15.32	0.15
Exposed roof: Roof (1)	69.19	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^2K]**
Opening, WINDOWS	10.98	East	0.7	1.1 **(!)**
Opening, WINDOWS	10.98	West	0.7	1.1 **(!)**
Opening, WINDOWS	7.75	West	0.7	1.1 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
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	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

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	83.7%
Emitter type	Underfloor
Flow temperature	
System type	Combi boiler
Manufacturer	Vaillant
Model	ecoFIT sustain 835
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

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

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
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: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Summary for Input Data

elmhurst energy

Property Reference	Fortess Road	**Issued on Date**	02/07/2023
Assessment Reference	Flat 4 - Boiler	**Prop Type Ref**	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	84 B	**DER**	16.43	**TER**	15.11
Environmental	87 B	**% DER < TER**			-8.74
CO_2 Emissions (t/year)	1.02	**DFEE**	42.69	**TFEE**	41.13
Compliance Check	See BREL	**% DFEE < TFEE**			-3.79
% DPER < TPER	-12.90	**DPER**	91.01	**TPER**	80.61

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

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

Orientation	East	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	4	
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/m²K
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 m²	0.00 m
Ground floor:	1.00 m	69.97 m²	2.52 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	29.00	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	85.60	55.89	0.00	None	29.71	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	15.32	15.32	0.50	Stairwell Access Corridor 1	0.00	Enter Gross Area

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	69.19	0.00	None	0.00	Enter Gross Area	0.00

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	69.19

Summary for Input Data

elmhurst energy

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	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	WINDOWS	EXTERNAL	East	10.98	0
Opening	WINDOWS	EXTERNAL	West	10.98	0
Opening	WINDOWS	EXTERNAL	West	7.75	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	11.04	0.30	0.30	No
E3 Sill	Independently assessed	6.70	0.04	0.04	No
E4 Jamb	Independently assessed	47.42	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	38.92	0.07	0.07	No
E16 Corner (normal)	Independently assessed	2.50	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.50	-0.09	-0.09	No
E18 Party wall between dwellings	Independently assessed	7.50	0.06	0.06	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	5.69	0.00	0.00	No
E14 Flat roof	Independently assessed	22.48	0.04	0.04	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.37	0.12	0.12	No

Y-value	0.06	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP_{50}	0.10	m³/(h.m²) @ 50 Pa
19.0 Mechanical Ventilation		
Mechanical Ventilation		
Mechanical Ventilation System Present	No	
20.0 Fans, Open Fireplaces, Flues		
21.0 Fixed Cooling System	No	
22.0 Lighting		
No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	11

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	17960	
Fuel Type	Mains gas	
SAP Code	0	
In Winter	88.70	
In Summer	76.40	
Model Name	ecoFIT sustain 835	
Manufacturer	Vaillant	
System Type	Combi boiler	
Controls SAP Code	2110	
Delayed Start Stat	No	
Burner Control	Modulating	
HETAS approved System	No	

Summary for Input Data

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	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Unknown
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2 — None

26.0 Heat Networks — 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
Bath Count	1
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 — None

Cylinder Stat	No
Cylinder In Heated Space	No
Independent Time Control	No
In Airing Cupboard	No

31.0 Thermal Store — None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 4 - Boiler	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	84 B	DER	16.43	TER	15.11
Environmental	87 B	% DER < TER			-8.74
CO_2 Emissions (t/year)	1.02	DFEE	42.69	TFEE	41.13
Compliance Check	See BREL	% DFEE < TFEE			-3.79
% DPER < TPER	-12.90	DPER	91.01	TPER	80.61

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3201 (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) =	0.3201 (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	0.4082	0.4002	0.3922	0.3522	0.3442	0.3041	0.3041	0.2961	0.3201	0.3442	0.3602	0.3762	(22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100	(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428			(33)
Party Floor 1			69.1900			40.0000	2767.6000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 119.6943 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5118 (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	33.9408	33.7526	33.5681	32.7015	32.5394	31.7846	31.7846	31.6448	32.0753	32.5394	32.8674	33.2103	(38)
Heat transfer coeff	93.4527	93.2644	93.0799	92.2133	92.0512	91.2964	91.2964	91.1567	91.5872	92.0512	92.3792	92.7221	(39)

Average = Sum(39)m / 12 = 92.2126

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3356	1.3329	1.3303	1.3179	1.3156	1.3048	1.3048	1.3028	1.3089	1.3156	1.3203	1.3252	(40)
HLP (average)												1.3179	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2454 (42)
Hot water usage for mixer showers

61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305	(42a)

Hot water usage for baths

28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399	(42b)

Hot water usage for other uses

39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054	(42c)

Average daily hot water use (litres/day) 119.1303 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)

Energy content (annual) Total = Sum(45)m = 1978.7239

Distribution loss (46)m = 0.15 x (45)m	30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(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	0.6822	0.6204	0.6774	0.6115	0.6058	0.5557	0.5470	0.5589	0.5543	0.6044	0.6252	0.6755	(61)
Total heat required for water heating calculated for each month	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(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	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)

Total per year (kWh/year) = Sum(64)m = 1986.0422 (64)
12Total per year (kWh/year) 1986 (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

68.4220	60.2014	63.2505	54.0090	51.2477	44.9811	43.5589	45.9828	47.2481	54.1120	59.2701	67.4718	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.4784	110.1368	99.4784	102.7943	99.4784	102.7943	99.4784	99.4784	102.7943	99.4784	102.7943	99.4784	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2270	199.2736	194.1163	183.1369	169.2773	156.2513	147.5491	145.5025	150.6599	161.6393	175.4988	188.5249	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	(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)	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	(71)
Water heating gains (Table 5)	91.9650	89.5853	85.0141	75.0125	68.8813	62.4738	58.5469	61.8048	65.6224	72.7312	82.3196	90.6878	(72)
Total internal gains													

	448.3514	458.6767	438.2897	420.6247	397.3180	378.2004	362.2553	363.4667	375.7575	393.5298	420.2937	438.3720 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.9800	19.6403	0.6300	0.7000	0.7700	65.9055 (76)
West	18.7300	19.6403	0.6300	0.7000	0.7700	112.4235 (80)

Solar gains	178.3289	348.8492	574.5050	837.8812	1026.8549	1051.1687	1000.7555	859.6342	668.1730	413.9390	222.3552	146.6490 (83)
Total gains	626.6803	807.5259	1012.7947	1258.5059	1424.1729	1429.3691	1363.0108	1223.1008	1043.9306	807.4688	642.6489	585.0211 (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	24.8938	24.9440	24.9935	25.2284	25.2728	25.4817	25.4817	25.5208	25.4008	25.2728	25.1831	25.0899	
alpha	2.6596	2.6629	2.6662	2.6819	2.6849	2.6988	2.6988	2.7014	2.6934	2.6849	2.6789	2.6727	
util living area	0.9452	0.9012	0.8217	0.6832	0.5289	0.3863	0.2869	0.3301	0.5321	0.7873	0.9151	0.9531	(86)
MIT	18.6140	19.0918	19.7230	20.3661	20.7451	20.9203	20.9737	20.9612	20.8100	20.2029	19.2774	18.5281	(87)
Th 2	19.8130	19.8151	19.8172	19.8268	19.8286	19.8371	19.8371	19.8386	19.8338	19.8286	19.8250	19.8212	(88)
util rest of house	0.9360	0.8859	0.7960	0.6433	0.4765	0.3227	0.2141	0.2514	0.4604	0.7468	0.8991	0.9452	(89)
MIT 2	17.0839	17.6770	18.4447	19.1977	19.6074	19.7833	19.8251	19.8197	19.6919	19.0448	17.9267	16.9812	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	17.7181	18.2634	18.9745	19.6819	20.0789	20.2545	20.3011	20.2928	20.1553	19.5248	18.4865	17.6223	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7181	18.2634	18.9745	19.6819	20.0789	20.2545	20.3011	20.2928	20.1553	19.5248	18.4865	17.6223	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9141	0.8607	0.7749	0.6380	0.4882	0.3460	0.2436	0.2828	0.4811	0.7349	0.8758	0.9248	(94)
Useful gains	572.8785	695.0708	784.7747	802.9828	695.2109	494.6239	331.9732	345.8631	502.2044	593.3924	562.8301	541.0444	(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	1253.9553	1246.3281	1161.1283	994.2393	771.2892	516.2384	337.9009	354.8573	554.5891	821.5355	1051.8757	1244.5445	(97)
Space heating kWh	506.7211	370.4449	280.0071	137.7046	56.6023	0.0000	0.0000	0.0000	0.0000	169.7384	352.1129	523.4041	(98a)
Space heating requirement - total per year (kWh/year)												2396.7354	
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	506.7211	370.4449	280.0071	137.7046	56.6023	0.0000	0.0000	0.0000	0.0000	169.7384	352.1129	523.4041	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2396.7354	
Space heating per m2											(98c) / (4) =	34.2538	(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 %)	83.7000 (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	506.7211	370.4449	280.0071	137.7046	56.6023	0.0000	0.0000	0.0000	0.0000	169.7384	352.1129	523.4041	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	605.4016	442.5865	334.5366	164.5217	67.6252	0.0000	0.0000	0.0000	0.0000	202.7938	420.6844	625.3334	(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	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)
Efficiency of water heater												76.4000	(216)
(217)m	84.7567	84.2448	83.2737	81.5882	79.3535	76.4000	76.4000	76.4000	76.4000	82.2179	84.1443	84.8799	(217)

Fuel for water heating, kWh/month

	242.9891	215.1002	228.6378	199.2749	194.4195	177.2506	171.6491	181.1947	186.1742	198.1233	212.0298	239.2676 (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	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678 (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	2863.4832 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2446.1109 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	155.2231 (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	5550.8172 (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	2863.4832	0.2100	601.3315	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2446.1109	0.2100	513.6833	(264)
Space and water heating			1115.0148	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			1149.3475	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.4300	(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	2863.4832	1.1300	3235.7360	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2446.1109	1.1300	2764.1053	(278)
Space and water heating			5999.8413	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	155.2231	1.5338	238.0864	(282)
Total Primary energy kWh/year			6368.0285	(286)
Dwelling Primary energy Rate (DPER)			91.0100	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 69.9700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1134	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3634	(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) =	0.3634	(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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3634	0.3907	0.4089	0.4270	(22b)
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5836	0.5912	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			17.4800	1.1450	20.0153			(27)
EXTERNAL	85.6000	17.4800	68.1200	0.1800	12.2616			(29a)
HALLWAY	15.3200		15.3200	0.1800	2.7576			(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109			(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.6454			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	119.6943	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.0500	0.5520
E3 Sill	6.7000	0.0500	0.3350
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0800	1.7984
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.2752	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	50.9206	(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	35.3402	35.0977	34.8599	33.7431	33.5342	32.5615	32.5615	32.3814	32.9362	33.5342	33.9569	34.3988	(38)
Heat transfer coeff	86.2608	86.0182	85.7805	84.6637	84.4548	83.4821	83.4821	83.3020	83.8567	84.4548	84.8775	85.3194	(39)
Average = Sum(39)m / 12 =												84.6627	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2328	1.2294	1.2260	1.2100	1.2070	1.1931	1.1931	1.1905	1.1985	1.2070	1.2131	1.2194	(40)
HLP (average)												1.2100	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2454	(42)
Hot water usage for mixer showers		

	61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305 (42a)
Hot water usage for baths												
	26.7283	26.3313	25.7724	24.7417	23.9699	23.1141	22.6519	23.2070	23.8114	24.7271	25.7790	26.6379 (42b)
Hot water usage for other uses												
	37.6251	36.2569	34.8887	33.5205	32.1524	30.7842	30.7842	32.1524	33.5205	34.8887	36.2569	37.6251 (42c)
Average daily hot water use (litres/day)												116.0258 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	126.2210	123.5261	120.2441	115.2530	111.2000	106.8428	105.1679	108.4358	111.8822	116.4567	121.5247	125.8936	(44)
Energy conte	199.9032	175.8995	184.8107	157.7756	149.6966	131.3756	127.1915	134.2661	137.9620	158.0306	173.1342	197.1189	(45)
Energy content (annual)											Total = Sum(45)m =	1927.1644	
Distribution loss (46)m = 0.15 x (45)m													
	29.9855	26.3849	27.7216	23.6663	22.4545	19.7063	19.0787	20.1399	20.6943	23.7046	25.9701	29.5678	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	250.8621	221.9269	235.7696	207.0906	200.6555	180.6907	178.1504	185.2250	187.2770	208.9895	222.4492	248.0778	(62)
WWHRS	-28.2833	-25.0140	-26.1932	-21.6890	-20.2133	-17.2967	-16.2129	-17.2408	-17.8958	-21.0972	-23.9006	-27.7595	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	222.5788	196.9129	209.5764	185.4017	180.4422	163.3940	161.9375	167.9842	169.3812	187.8923	198.5486	220.3183	(64)
											Total per year (kWh/year) = Sum(64)m =	2264.3681	(64)
12Total per year (kWh/year)												2264	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	79.2075	69.9934	74.1893	64.7891	62.5139	56.0112	55.0309	57.3832	58.2011	65.2849	69.8959	78.2818	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	99.4784	110.1368	99.4784	102.7943	99.4784	102.7943	99.4784	99.4784	102.7943	99.4784	102.7943	99.4784	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.2270	199.2736	194.1163	183.1369	169.2773	156.2513	147.5491	145.5025	150.6599	161.6393	175.4988	188.5249	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	(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)													
	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	(71)
Water heating gains (Table 5)													
	106.4617	104.1569	99.7168	89.9849	84.0240	77.7933	73.9663	77.1280	80.8349	87.7485	97.0776	105.2174	(72)
Total internal gains													
	462.8481	473.2483	452.9924	435.5971	412.4606	393.5199	377.6747	378.7898	390.9701	408.5472	435.0517	452.9016	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4600	19.6403	0.6300	0.7000	0.7700	38.7750	(76)
West	11.0200	19.6403	0.6300	0.7000	0.7700	66.1456	(80)

Solar gains	104.9206	205.2469	338.0123	492.9708	604.1543	618.4594	588.7986	505.7693	393.1223	243.5427	130.8236	86.2816	(83)
Total gains	567.7687	678.4951	791.0047	928.5679	1016.6149	1011.9793	966.4733	884.5591	784.0924	652.0898	565.8753	539.1832	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.9693	27.0453	27.1203	27.4780	27.5460	27.8670	27.8670	27.9272	27.7425	27.5460	27.4088	27.2669	
alpha	2.7980	2.8030	2.8080	2.8319	2.8364	2.8578	2.8578	2.8618	2.8495	2.8364	2.8273	2.8178	
util living area													
	0.9539	0.9261	0.8757	0.7742	0.6381	0.4841	0.3649	0.4099	0.6200	0.8375	0.9306	0.9593	(86)
MIT	18.7161	19.0759	19.5969	20.2183	20.6499	20.8858	20.9622	20.9469	20.7625	20.1494	19.3306	18.6631	(87)
Th 2	19.8938	19.8966	19.8993	19.9120	19.9144	19.9255	19.9255	19.9276	19.9212	19.9144	19.9096	19.9045	(88)
util rest of house													
	0.9462	0.9143	0.8561	0.7405	0.5871	0.4148	0.2814	0.3226	0.5500	0.8042	0.9175	0.9526	(89)
MIT 2	17.2601	17.7112	18.3568	19.1088	19.5960	19.8437	19.9069	19.8995	19.7337	19.0528	18.0467	17.1998	(90)
Living area fraction											fLA = Living area / (4) =	0.4145	(91)

MIT	17.8636	18.2768	18.8708	19.5686	20.0328	20.2756	20.3443	20.3336	20.1601	19.5073	18.5788	17.8063 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8636	18.2768	18.8708	19.5686	20.0328	20.2756	20.3443	20.3336	20.1601	19.5073	18.5788	17.8063 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9273	0.8922	0.8343	0.7287	0.5930	0.4381	0.3146	0.3565	0.5665	0.7896	0.8969	0.9348	(94)
Useful gains	526.4683	605.3406	659.9481	676.6751	602.8335	443.3731	304.0703	315.3830	444.1563	514.9032	507.5336	504.0316	(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													
	1170.0054	1150.6530	1061.1699	903.2460	703.7446	473.8107	312.5801	327.6779	508.1814	752.2621	974.2944	1160.8820	(97)
Space heating kWh													
	478.7917	366.4499	298.5090	163.1311	75.0779	0.0000	0.0000	0.0000	0.0000	176.5950	336.0677	488.6967	(98a)
Space heating requirement - total per year (kWh/year)												2383.3190	
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													
	478.7917	366.4499	298.5090	163.1311	75.0779	0.0000	0.0000	0.0000	0.0000	176.5950	336.0677	488.6967	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2383.3190	
Space heating per m2											(98c) / (4) =	34.0620	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	478.7917	366.4499	298.5090	163.1311	75.0779	0.0000	0.0000	0.0000	0.0000	176.5950	336.0677	488.6967	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	518.1728	396.5908	323.0617	176.5488	81.2531	0.0000	0.0000	0.0000	0.0000	191.1201	363.7097	528.8925	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	222.5788	196.9129	209.5764	185.4017	180.4422	163.3940	161.9375	167.9842	169.3812	187.8923	198.5486	220.3183	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.9778	85.6922	85.1389	84.1083	82.6492	80.3000	80.3000	80.3000	80.3000	84.2487	85.4993	86.0367	(217)
Fuel for water heating, kWh/month													
	258.8793	229.7910	246.1583	220.4321	218.3229	203.4794	201.6656	209.1958	210.9355	223.0210	232.2226	256.0747	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	20.6696	16.5820	14.9302	10.9385	8.4492	6.9031	7.7077	10.0187	13.0133	17.0742	19.2852	21.2441	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.5138	-23.2706	-35.5642	-42.6000	-48.2591	-45.9029	-45.3453	-41.6467	-35.5473	-27.7326	-17.5454	-13.2546	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.9762	-10.7494	-21.9006	-33.6958	-45.3516	-45.8605	-45.3202	-38.0041	-27.3779	-15.6302	-6.7252	-3.9144	(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												2579.3496	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2710.1782	(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)												166.8159	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-691.6885	(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		4850.6551 (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	2579.3496	0.2100	541.6634	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2710.1782	0.2100	569.1374	(264)
Space and water heating			1110.8008	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	166.8159	0.1443	24.0767	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-392.1824	0.1333	-52.2797	
PV Unit electricity exported	-299.5061	0.1252	-37.4974	
Total			-89.7771	(269)
Total CO2, kg/year			1057.0296	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.1100	(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	2579.3496	1.1300	2914.6650	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2710.1782	1.1300	3062.5014	(278)
Space and water heating			5977.1664	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	166.8159	1.5338	255.8678	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-392.1824	1.4926	-585.3707	
PV Unit electricity exported	-299.5061	0.4595	-137.6312	
Total			-723.0020	(283)
Total Primary energy kWh/year			5640.1330	(286)
Target Primary Energy Rate (TPER)			80.6100	(287)

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 4 - Boiler	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	84 B	DER	16.43	TER	15.11
Environmental	87 B	% DER < TER			-8.74
CO_2 Emissions (t/year)	1.02	DFEE	42.69	TFEE	41.13
Compliance Check	See BREL	% DFEE < TFEE			-3.79
% DPER < TPER	-12.90	DPER	91.01	TPER	80.61

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 ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3201 (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) =	0.3201 (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	0.4082	0.4002	0.3922	0.3522	0.3442	0.3041	0.3041	0.2961	0.3201	0.3442	0.3602	0.3762	(22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100	(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428			(33)
Party Floor 1			69.1900			40.0000	2767.6000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 119.6943 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5118 (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	33.9408	33.7526	33.5681	32.7015	32.5394	31.7846	31.7846	31.6448	32.0753	32.5394	32.8674	33.2103	(38)
Heat transfer coeff	93.4527	93.2644	93.0799	92.2133	92.0512	91.2964	91.2964	91.1567	91.5872	92.0512	92.3792	92.7221	(39)
Average = Sum(39)m / 12 =												92.2126	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3356	1.3329	1.3303	1.3179	1.3156	1.3048	1.3048	1.3028	1.3089	1.3156	1.3203	1.3252	(40)
HLP (average)												1.3179	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2454 (42)
Hot water usage for mixer showers

61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305	(42a)

Hot water usage for baths

28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399	(42b)

Hot water usage for other uses

39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054	(42c)

Average daily hot water use (litres/day) 119.1303 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)
Energy content (annual)										Total = Sum(45)m =		1978.7239	
Distribution loss (46)m = 0.15 x (45)m	30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(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	0.6822	0.6204	0.6774	0.6115	0.6058	0.5557	0.5470	0.5589	0.5543	0.6044	0.6252	0.6755	(61)
Total heat required for water heating calculated for each month	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(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	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)
										Total per year (kWh/year) = Sum(64)m =		1986.0422	(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	68.4220	60.2014	63.2505	54.0090	51.2477	44.9811	43.5589	45.9828	47.2481	54.1120	59.2701	67.4718	(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	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9734	19.5166	15.8720	12.0161	8.9822	7.5831	8.1938	10.6507	14.2953	18.1512	21.1851	22.5841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.3687	297.4233	289.7258	273.3386	252.6527	233.2109	220.2226	217.1679	224.8655	241.2527	261.9386	281.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	(69)
Pumps, fans	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)	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	(71)
Water heating gains (Table 5)	91.9650	89.5853	85.0141	75.0125	68.8813	62.4738	58.5469	61.8048	65.6224	72.7312	82.3196	90.6878	(72)
Total internal gains	506.9329	505.1510	489.2375	458.9929	429.1419	398.8935	382.5890	385.2491	400.4089	430.7607	464.0689	493.2781	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.9800	19.6403	0.6300	0.7000	0.7700	65.9055 (76)
West	18.7300	19.6403	0.6300	0.7000	0.7700	112.4235 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	178.3289	348.8492	574.5050	837.8812	1026.8549	1051.1687	1000.7555	859.6342	668.1730	413.9390	222.3552	146.6490	(83)
Total gains	685.2618	854.0002	1063.7425	1296.8741	1455.9968	1450.0622	1383.3445	1244.8833	1068.5819	844.6997	686.4241	639.9271	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.8938	24.9440	24.9935	25.2284	25.2728	25.4817	25.4817	25.5208	25.4008	25.2728	25.1831	25.0899	
alpha	2.6596	2.6629	2.6662	2.6819	2.6849	2.6988	2.6988	2.7014	2.6934	2.6849	2.6789	2.6727	
util living area	0.9339	0.8901	0.8071	0.6716	0.5202	0.3815	0.2830	0.3248	0.5228	0.7725	0.9034	0.9432	(86)
MIT	18.7314	19.1718	19.7880	20.3937	20.7554	20.9227	20.9745	20.9627	20.8180	20.2445	19.3566	18.6417	(87)
Th 2	19.8130	19.8151	19.8172	19.8268	19.8286	19.8371	19.8371	19.8386	19.8338	19.8286	19.8250	19.8212	(88)
util rest of house	0.9232	0.8735	0.7802	0.6314	0.4682	0.3185	0.2110	0.2472	0.4517	0.7307	0.8857	0.9338	(89)
MIT 2	17.2295	17.7739	18.5201	19.2270	19.6168	19.7850	19.8255	19.8205	19.6984	19.0898	18.0225	17.1227	(90)
Living area fraction									fLA = Living area / (4) =			0.4145	(91)
MIT	17.8520	18.3533	19.0456	19.7105	20.0887	20.2565	20.3018	20.2939	20.1625	19.5684	18.5754	17.7522	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8520	18.3533	19.0456	19.7105	20.0887	20.2565	20.3018	20.2939	20.1625	19.5684	18.5754	17.7522	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8998	0.8483	0.7602	0.6271	0.4801	0.3417	0.2402	0.2782	0.4726	0.7202	0.8621	0.9118	(94)
Useful gains	616.6069	724.4397	808.6761	813.3218	699.0536	495.4641	332.2327	346.3171	505.0306	608.3626	591.7660	583.4628	(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	1266.4667	1254.7133	1167.7447	996.8740	772.1868	516.4224	337.9573	354.9561	555.2431	825.5496	1060.0913	1256.5920	(97)
Space heating kWh	483.4957	356.3439	267.1470	132.1576	54.4111	0.0000	0.0000	0.0000	0.0000	161.5871	337.1943	500.8081	(98a)
Space heating requirement - total per year (kWh/year)												2293.1448	
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	483.4957	356.3439	267.1470	132.1576	54.4111	0.0000	0.0000	0.0000	0.0000	161.5871	337.1943	500.8081	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2293.1448	
Space heating per m2											(98c) / (4) =	32.7733	(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 %)	83.7000 (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	483.4957	356.3439	267.1470	132.1576	54.4111	0.0000	0.0000	0.0000	0.0000	161.5871	337.1943	500.8081	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	577.6532	425.7394	319.1721	157.8944	65.0073	0.0000	0.0000	0.0000	0.0000	193.0551	402.8605	598.3371	(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	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)
Efficiency of water heater												76.4000	(216)
(217)m	84.6300	84.1339	83.1307	81.4653	79.2659	76.4000	76.4000	76.4000	76.4000	82.0672	84.0195	84.7627	(217)
Fuel for water heating, kWh/month													

	243.3530	215.3836	229.0309	199.5756	194.6346	177.2506	171.6491	181.1947	186.1742	198.4870	212.3448	239.5984 (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	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	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678 (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	2739.7191 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2448.6767 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	155.2231 (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	5429.6189 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2739.7191	3.6400	99.7258	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2448.6767	3.6400	89.1318	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	155.2231	16.4900	25.5963	(250)
Additional standing charges			92.0000	(251)
Total energy cost			320.6353	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0040 (257)
SAP value		83.7253
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2739.7191	0.2100	575.3410	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2448.6767	0.2100	514.2221	(264)
Space and water heating			1089.5631	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			1123.8959	(272)
CO2 emissions per m2			16.0600	(273)
EI value			86.9008	
EI rating			87	(274)
EI band			B	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 69.9700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

2. Ventilation rate

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

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3201	(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) =	0.3201	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3682	0.3522	0.3522	0.3201	0.3201	0.2801	0.2961	0.2961	0.2961	0.3121	0.3121	0.3442	(22b)
Effective ac	0.5678	0.5620	0.5620	0.5512	0.5512	0.5392	0.5438	0.5438	0.5438	0.5487	0.5487	0.5592	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100	(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428			(33)
Party Floor 1			69.1900			40.0000	2767.6000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8375.0100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		119.6943	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0690	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	59.5118	(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	33.0370	32.7015	32.7015	32.0753	32.0753	31.3765	31.6448	31.6448	31.6448	31.9281	31.9281	32.5394	(38)
Heat transfer coeff													

	92.5488	92.2133	92.2133	91.5872	91.5872	90.8883	91.1567	91.1567	91.1567	91.4399	91.4399	92.0512 (39)
Average = Sum(39)m / 12 =												91.6199

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3227	1.3179	1.3179	1.3089	1.3089	1.2990	1.3028	1.3028	1.3028	1.3068	1.3068	1.3156	(40)
HLP (average)												1.3094	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2454 (42)
Hot water usage for mixer showers												
	61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305 (42a)
Hot water usage for baths												
	28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399 (42b)
Hot water usage for other uses												
	39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054 (42c)
Average daily hot water use (litres/day)												119.1303 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)
Energy content (annual)										Total = Sum(45)m =		1978.7239	
Distribution loss (46)m = 0.15 x (45)m													
	30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(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	0.6822	0.6204	0.6774	0.6115	0.6058	0.5557	0.5470	0.5589	0.5543	0.6044	0.6252	0.6755	(61)
Total heat required for water heating calculated for each month													
	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(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													
	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)
										Total per year (kWh/year) = Sum(64)m =		1986.0422	(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													
	68.4220	60.2014	63.2505	54.0090	51.2477	44.9811	43.5589	45.9828	47.2481	54.1120	59.2701	67.4718	(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	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.9734	19.5166	15.8720	12.0161	8.9822	7.5831	8.1938	10.6507	14.2953	18.1512	21.1851	22.5841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	294.3687	297.4233	289.7258	273.3386	252.6527	233.2109	220.2226	217.1679	224.8655	241.2527	261.9386	281.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	(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)													
	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	(71)
Water heating gains (Table 5)													
	91.9650	89.5853	85.0141	75.0125	68.8813	62.4738	58.5469	61.8048	65.6224	72.7312	82.3196	90.6878	(72)
Total internal gains													
	506.9329	505.1510	489.2375	458.9929	429.1419	398.8935	382.5890	385.2491	400.4089	430.7607	464.0689	493.2781	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.9800	21.5869	0.6300	0.7000	0.7700	72.4378	(76)
West	18.7300	21.5869	0.6300	0.7000	0.7700	123.5665	(80)

Solar gains	196.0043	344.0484	567.5417	851.7109	1013.3964	1106.4838	1051.1687	933.2252	723.8340	445.6033	252.3638	158.2444	(83)
Total gains	702.9371	849.1994	1056.7792	1310.7038	1442.5383	1505.3773	1433.7577	1318.4743	1124.2429	876.3641	716.4327	651.5225	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	25.1369	25.2284	25.2284	25.4008	25.4008	25.5962	25.5208	25.5208	25.5208	25.4417	25.4417	25.2728	
alpha	2.6758	2.6819	2.6819	2.6934	2.6934	2.7064	2.7014	2.7014	2.7014	2.6961	2.6961	2.6849	
util living area	0.9195	0.8779	0.7776	0.6167	0.4449	0.2714	0.1642	0.1917	0.4101	0.7019	0.8748	0.9308	(86)
MIT	19.0277	19.3748	20.0205	20.5738	20.8652	20.9763	20.9962	20.9939	20.9224	20.5063	19.6717	18.9438	(87)
Th 2	19.8231	19.8268	19.8268	19.8338	19.8338	19.8416	19.8386	19.8386	19.8386	19.8355	19.8355	19.8286	(88)
util rest of house	0.9060	0.8589	0.7457	0.5703	0.3860	0.2054	0.0913	0.1130	0.3308	0.6474	0.8514	0.9188	(89)
MIT 2	17.6078	18.0340	18.8067	19.4335	19.7304	19.8303	19.8380	19.8375	19.7925	19.3892	18.4170	17.5084	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	18.1963	18.5898	19.3098	19.9061	20.2007	20.3053	20.3181	20.3168	20.2608	19.8522	18.9370	18.1033	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1963	18.5898	19.3098	19.9061	20.2007	20.3053	20.3181	20.3168	20.2608	19.8522	18.9370	18.1033	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8820	0.8346	0.7300	0.5734	0.4050	0.2322	0.1216	0.1457	0.3605	0.6483	0.8294	0.8958	(94)
Useful gains	619.9915	708.7698	771.4202	751.5189	584.2678	349.4868	174.3215	192.0407	405.2554	568.1347	594.1803	583.6556	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1184.2817	1179.3862	1061.3576	879.7942	622.8611	354.9471	174.8436	192.9580	424.8657	708.8605	972.6480	1169.3581	(97)
Space heating kWh	419.8319	316.2542	215.7134	92.3582	28.7134	0.0000	0.0000	0.0000	0.0000	104.7000	272.4967	435.7626	(98a)
Space heating requirement - total per year (kWh/year)												1885.8305	
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	419.8319	316.2542	215.7134	92.3582	28.7134	0.0000	0.0000	0.0000	0.0000	104.7000	272.4967	435.7626	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1885.8305	
Space heating per m2										(98c) / (4) =		26.9520	(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 %)												83.7000	(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	419.8319	316.2542	215.7134	92.3582	28.7134	0.0000	0.0000	0.0000	0.0000	104.7000	272.4967	435.7626	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	501.5913	377.8426	257.7221	110.3443	34.3051	0.0000	0.0000	0.0000	0.0000	125.0896	325.5636	520.6244	(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	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)
Efficiency of water heater												76.4000	(216)
(217)m	84.2367	83.7863	82.4749	80.4410	78.0993	76.4000	76.4000	76.4000	76.4000	80.7830	83.3881	84.3814	(217)
Fuel for water heating, kWh/month	244.4890	216.2771	230.8522	202.1168	197.5417	177.2506	171.6491	181.1947	186.1742	201.6424	213.9526	240.6813	(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	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678	(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	2253.0830 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2463.8218 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	155.2231 (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	4958.1279 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2253.0830	3.5000	78.8579 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2463.8218	3.5000	86.2338 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154 (249)
Energy for lighting	155.2231	18.3900	28.5455 (250)
Additional standing charges			94.0000 (251)
Total energy cost			303.4526 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2253.0830	0.2100	473.1474 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2463.8218	0.2100	517.4026 (264)
Space and water heating			990.5500 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	155.2231	0.1443	22.4035 (268)
Total CO2, kg/year			1024.8828 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2253.0830	1.1300	2545.9838 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2463.8218	1.1300	2784.1186 (278)
Space and water heating			5330.1024 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	155.2231	1.5338	238.0864 (282)
Total Primary energy kWh/year			5698.2896 (286)

SAP 10 EPC IMPROVEMENTS

Flat 4 - Boiler

Current energy efficiency rating:	B 84
Current environmental impact rating:	B 87

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact

(none)
Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 87

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£44	£44	£0
Mains gas	£259	£259	£0
Space heating	£189	£189	£0
Water heating	£86	£86	£0
Lighting	£29	£29	£0
Total cost of fuels	£303	£303	£0
Total cost of uses	£304	£304	£0
Delivered energy	71 kWh/m²	71 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	15 kg/m²	15 kg/m²	0 kg/m²
Primary energy	81 kWh/m²	81 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3201	(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) =	0.3201	(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	0.4082	0.4002	0.3922	0.3522	0.3442	0.3041	0.3041	0.2961	0.3201	0.3442	0.3602	0.3762	(22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5649	0.5708	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)

EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000 (29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000 (29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100 (30)
Total net area of external elements Aum(A, m2)			170.1100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428		(33)
Party Floor 1			69.1900			40.0000	2767.6000 (32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		119.6943 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0690 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5118 (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	33.9408	33.7526	33.5681	32.7015	32.5394	31.7846	31.7846	31.6448	32.0753	32.5394	32.8674	33.2103	(38)
Heat transfer coeff	93.4527	93.2644	93.0799	92.2133	92.0512	91.2964	91.2964	91.1567	91.5872	92.0512	92.3792	92.7221	(39)
Average = Sum(39)m / 12 =												92.2126	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3356	1.3329	1.3303	1.3179	1.3156	1.3048	1.3048	1.3028	1.3089	1.3156	1.3203	1.3252	(40)
HLP (average)												1.3179	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2454	(42)
Hot water usage for mixer showers	61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305	(42a)
Hot water usage for baths	28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399	(42b)
Hot water usage for other uses	39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054	(42c)
Average daily hot water use (litres/day)												119.1303	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)
Energy content (annual)										Total = Sum(45)m =		1978.7239	
Distribution loss (46)m = 0.15 x (45)m	30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(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	0.6822	0.6204	0.6774	0.6115	0.6058	0.5557	0.5470	0.5589	0.5543	0.6044	0.6252	0.6755	(61)
Total heat required for water heating calculated for each month	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(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	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)
									Total per year (kWh/year) = Sum(64)m =			1986.0422	(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	68.4220	60.2014	63.2505	54.0090	51.2477	44.9811	43.5589	45.9828	47.2481	54.1120	59.2701	67.4718	(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	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9734	19.5166	15.8720	12.0161	8.9822	7.5831	8.1938	10.6507	14.2953	18.1512	21.1851	22.5841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.3687	297.4233	289.7258	273.3386	252.6527	233.2109	220.2226	217.1679	224.8655	241.2527	261.9386	281.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	(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)	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159 (71)
Water heating gains (Table 5)	91.9650	89.5853	85.0141	75.0125	68.8813	62.4738	58.5469	61.8048	65.6224	72.7312	82.3196	90.6878 (72)
Total internal gains	506.9329	505.1510	489.2375	458.9929	429.1419	398.8935	382.5890	385.2491	400.4089	430.7607	464.0689	493.2781 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.9800	19.6403	0.6300	0.7000	0.7700	65.9055 (76)
West	18.7300	19.6403	0.6300	0.7000	0.7700	112.4235 (80)

Solar gains	178.3289	348.8492	574.5050	837.8812	1026.8549	1051.1687	1000.7555	859.6342	668.1730	413.9390	222.3552	146.6490 (83)
Total gains	685.2618	854.0002	1063.7425	1296.8741	1455.9968	1450.0622	1383.3445	1244.8833	1068.5819	844.6997	686.4241	639.9271 (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	24.8938	24.9440	24.9935	25.2284	25.2728	25.4817	25.4817	25.5208	25.4008	25.2728	25.1831	25.0899	
alpha	2.6596	2.6629	2.6662	2.6819	2.6849	2.6988	2.6988	2.7014	2.6934	2.6849	2.6789	2.6727	
util living area	0.9339	0.8901	0.8071	0.6716	0.5202	0.3815	0.2830	0.3248	0.5228	0.7725	0.9034	0.9432	(86)
MIT	18.7314	19.1718	19.7880	20.3937	20.7554	20.9227	20.9745	20.9627	20.8180	20.2445	19.3566	18.6417	(87)
Th 2	19.8130	19.8151	19.8172	19.8268	19.8286	19.8371	19.8371	19.8386	19.8338	19.8286	19.8250	19.8212	(88)
util rest of house	0.9232	0.8735	0.7802	0.6314	0.4682	0.3185	0.2110	0.2472	0.4517	0.7307	0.8857	0.9338	(89)
MIT 2	17.2295	17.7739	18.5201	19.2270	19.6168	19.7850	19.8255	19.8205	19.6984	19.0898	18.0225	17.1227	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	17.8520	18.3533	19.0456	19.7105	20.0887	20.2565	20.3018	20.2939	20.1625	19.5684	18.5754	17.7522	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8520	18.3533	19.0456	19.7105	20.0887	20.2565	20.3018	20.2939	20.1625	19.5684	18.5754	17.7522	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8998	0.8483	0.7602	0.6271	0.4801	0.3417	0.2402	0.2782	0.4726	0.7202	0.8621	0.9118	(94)
Useful gains	616.6069	724.4397	808.6761	813.3218	699.0536	495.4641	332.2327	346.3171	505.0306	608.3626	591.7660	583.4628	(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	1266.4667	1254.7133	1167.7447	996.8740	772.1868	516.4224	337.9573	354.9561	555.2431	825.5496	1060.0913	1256.5920	(97)
Space heating kWh	483.4957	356.3439	267.1470	132.1576	54.4111	0.0000	0.0000	0.0000	0.0000	161.5871	337.1943	500.8081	(98a)
Space heating requirement - total per year (kWh/year)												2293.1448	
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	483.4957	356.3439	267.1470	132.1576	54.4111	0.0000	0.0000	0.0000	0.0000	161.5871	337.1943	500.8081	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2293.1448	
Space heating per m2											(98c) / (4) =	32.7733	(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 %)	83.7000	(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	483.4957	356.3439	267.1470	132.1576	54.4111	0.0000	0.0000	0.0000	0.0000	161.5871	337.1943	500.8081	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	577.6532	425.7394	319.1721	157.8944	65.0073	0.0000	0.0000	0.0000	0.0000	193.0551	402.8605	598.3371	(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

	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902 (64)
Efficiency of water heater												76.4000 (216)
(217)m	84.6300	84.1339	83.1307	81.4653	79.2659	76.4000	76.4000	76.4000	76.4000	82.0672	84.0195	84.7627 (217)
Fuel for water heating, kWh/month												
	243.3530	215.3836	229.0309	199.5756	194.6346	177.2506	171.6491	181.1947	186.1742	198.4870	212.3448	239.5984 (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	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	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678 (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	2739.7191 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	76.4000
Water heating fuel used	2448.6767 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	155.2231 (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	5429.6189 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2739.7191	3.6400	99.7258	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2448.6767	3.6400	89.1318	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	155.2231	16.4900	25.5963	(250)
Additional standing charges			92.0000	(251)
Total energy cost			320.6353	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0040 (257)
SAP value		83.7253
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2739.7191	0.2100	575.3410	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2448.6767	0.2100	514.2221	(264)
Space and water heating			1089.5631	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			1123.8959	(272)
CO2 emissions per m2			16.0600	(273)

EI value 86.9008
EI rating 87 (274)
EI band B

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 69.9700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3201	(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) =	0.3201	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3682	0.3522	0.3522	0.3201	0.3201	0.2801	0.2961	0.2961	0.2961	0.3121	0.3121	0.3442	(22b)
Effective ac	0.5678	0.5620	0.5620	0.5512	0.5512	0.5392	0.5438	0.5438	0.5438	0.5487	0.5487	0.5592	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100	(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428			(33)
Party Floor 1			69.1900			40.0000	2767.6000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		119.6943 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5118 (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	33.0370	32.7015	32.7015	32.0753	32.0753	31.3765	31.6448	31.6448	31.6448	31.9281	31.9281	32.5394	(38)
Heat transfer coeff	92.5488	92.2133	92.2133	91.5872	91.5872	90.8883	91.1567	91.1567	91.1567	91.4399	91.4399	92.0512	(39)

Average = Sum(39)m / 12 = 91.6199

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3227	1.3179	1.3179	1.3089	1.3089	1.2990	1.3028	1.3028	1.3028	1.3068	1.3068	1.3156	(40)
HLP (average)												1.3094	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2454 (42)

Hot water usage for mixer showers

61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305	(42a)

Hot water usage for baths

28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399	(42b)

Hot water usage for other uses

39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054	(42c)

Average daily hot water use (litres/day) 119.1303 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)

Energy content (annual) Total = Sum(45)m = 1978.7239

Distribution loss (46)m = 0.15 x (45)m

30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(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 0.6822	0.6204	0.6774	0.6115	0.6058	0.5557	0.5470	0.5589	0.5543	0.6044	0.6252	0.6755	(61)

Total heat required for water heating calculated for each month

205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(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

205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)

Total per year (kWh/year) = Sum(64)m = 1986.0422 (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

68.4220	60.2014	63.2505	54.0090	51.2477	44.9811	43.5589	45.9828	47.2481	54.1120	59.2701	67.4718	(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	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9734	19.5166	15.8720	12.0161	8.9822	7.5831	8.1938	10.6507	14.2953	18.1512	21.1851	22.5841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.3687	297.4233	289.7258	273.3386	252.6527	233.2109	220.2226	217.1679	224.8655	241.2527	261.9386	281.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	(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)	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	(71)
Water heating gains (Table 5)	91.9650	89.5853	85.0141	75.0125	68.8813	62.4738	58.5469	61.8048	65.6224	72.7312	82.3196	90.6878	(72)
Total internal gains	506.9329	505.1510	489.2375	458.9929	429.1419	398.8935	382.5890	385.2491	400.4089	430.7607	464.0689	493.2781	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.9800	21.5869	0.6300	0.7000	0.7700	72.4378	(76)
West	18.7300	21.5869	0.6300	0.7000	0.7700	123.5665	(80)

Solar gains	196.0043	344.0484	567.5417	851.7109	1013.3964	1106.4838	1051.1687	933.2252	723.8340	445.6033	252.3638	158.2444	(83)
Total gains	702.9371	849.1994	1056.7792	1310.7038	1442.5383	1505.3773	1433.7577	1318.4743	1124.2429	876.3641	716.4327	651.5225	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.1369	25.2284	25.2284	25.4008	25.4008	25.5962	25.5208	25.5208	25.5208	25.4417	25.4417	25.2728	
alpha	2.6758	2.6819	2.6819	2.6934	2.6934	2.7064	2.7014	2.7014	2.7014	2.6961	2.6961	2.6849	
util living area	0.9195	0.8779	0.7776	0.6167	0.4449	0.2714	0.1642	0.1917	0.4101	0.7019	0.8748	0.9308	(86)
MIT	19.0277	19.3748	20.0205	20.5738	20.8652	20.9763	20.9962	20.9939	20.9224	20.5063	19.6717	18.9438	(87)
Th 2	19.8231	19.8268	19.8268	19.8338	19.8338	19.8416	19.8386	19.8386	19.8386	19.8355	19.8355	19.8286	(88)
util rest of house	0.9060	0.8589	0.7457	0.5703	0.3860	0.2054	0.0913	0.1130	0.3308	0.6474	0.8514	0.9188	(89)
MIT 2	17.6078	18.0340	18.8067	19.4335	19.7304	19.8303	19.8380	19.8375	19.7925	19.3892	18.4170	17.5084	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	18.1963	18.5898	19.3098	19.9061	20.2007	20.3053	20.3181	20.3168	20.2608	19.8522	18.9370	18.1033	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1963	18.5898	19.3098	19.9061	20.2007	20.3053	20.3181	20.3168	20.2608	19.8522	18.9370	18.1033	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8820	0.8346	0.7300	0.5734	0.4050	0.2322	0.1216	0.1457	0.3605	0.6483	0.8294	0.8958	(94)
Useful gains	619.9915	708.7698	771.4202	751.5189	584.2678	349.4868	174.3215	192.0407	405.2554	568.1347	594.1803	583.6556	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1184.2817	1179.3862	1061.3576	879.7942	622.8611	354.9471	174.8436	192.9580	424.8657	708.8605	972.6480	1169.3581	(97)
Space heating kWh	419.8319	316.2542	215.7134	92.3582	28.7134	0.0000	0.0000	0.0000	0.0000	104.7000	272.4967	435.7626	(98a)
Space heating requirement - total per year (kWh/year)												1885.8305	
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	419.8319	316.2542	215.7134	92.3582	28.7134	0.0000	0.0000	0.0000	0.0000	104.7000	272.4967	435.7626	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1885.8305	
Space heating per m2										(98c) / (4) =		26.9520	(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 %)												83.7000	(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	419.8319	316.2542	215.7134	92.3582	28.7134	0.0000	0.0000	0.0000	0.0000	104.7000	272.4967	435.7626	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	501.5913	377.8426	257.7221	110.3443	34.3051	0.0000	0.0000	0.0000	0.0000	125.0896	325.5636	520.6244	(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	205.9496	181.2106	190.3951	162.5849	154.2788	135.4195	131.1399	138.4328	142.2371	162.8928	178.4110	203.0902	(64)
Efficiency of water heater												76.4000	(216)
(217)m	84.2367	83.7863	82.4749	80.4410	78.0993	76.4000	76.4000	76.4000	76.4000	80.7830	83.3881	84.3814	(217)
Fuel for water heating, kWh/month	244.4890	216.2771	230.8522	202.1168	197.5417	177.2506	171.6491	181.1947	186.1742	201.6424	213.9526	240.6813	(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	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678	(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	(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	2253.0830	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	76.4000	
Water heating fuel used	2463.8218	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	155.2231	(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	4958.1279	(238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2253.0830	3.5000	78.8579	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2463.8218	3.5000	86.2338	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	18.3900	15.8154	(249)
Energy for lighting	155.2231	18.3900	28.5455	(250)
Additional standing charges			94.0000	(251)
Total energy cost			303.4526	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2253.0830	0.2100	473.1474	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2463.8218	0.2100	517.4026	(264)
Space and water heating			990.5500	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			1024.8828	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2253.0830	1.1300	2545.9838	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2463.8218	1.1300	2784.1186	(278)
Space and water heating			5330.1024	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	155.2231	1.5338	238.0864	(282)
Total Primary energy kWh/year			5698.2896	(286)

Building Regulations England Part L (BREL) Compliance Report

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

Date: Sun 02 Jul 2023 20:29:43

Project Information			
Assessed By	Mark Simons	Building Type	Flat, Mid-terrace
OCDEA Registration	EES/004083	Assessment Date	2023-07-02

Dwelling Details			
Assessment Type	As designed	Total Floor Area	70 m^2
Site Reference	Fortess Road	Plot Reference	Flat 4 - Heatpump
Address	Flat 1 7 Fortess Road, LONDON, NW5 1AA		

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	*14.85 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.74 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*79.25 kWh_{PE}/m^2*	
Dwelling primary energy	39.24 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*41.1 kWh/m^2*	
Dwelling fabric energy efficiency	42.7 kWh/m^2	FAIL

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	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*	1.1	Opening (1.1)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	55.89	0.15
Sheltered wall: Walls (2)	15.32	0.15
Exposed roof: Roof (1)	69.19	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^2K]**
Opening, WINDOWS	10.98	East	0.7	1.1 **(!)**
Opening, WINDOWS	10.98	West	0.7	1.1 **(!)**
Opening, WINDOWS	7.75	West	0.7	1.1 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.3	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E7: Party floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0.07	
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	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Calculated by person with suitable expertise	0 **(!)**	
External wall	E14: Flat roof	Calculated by person with suitable expertise	0.04	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	

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	339.4%
Emitter type	Underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Midea
Model	MHC-V6W/D2N8-B
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 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: N/A		
Maximum permitted specific fan power	*N/A*	
Specific fan power	N/A	**N/A**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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

Summary for Input Data

elmhurst energy

Property Reference	Fortess Road	**Issued on Date**	02/07/2023
Assessment Reference	Flat 4 - Heatpump	**Prop Type Ref**	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	85 B	**DER**	3.74	**TER**	14.85
Environmental	97 A	**% DER < TER**			74.81
CO_2 Emissions (t/year)	0.24	**DFEE**	42.69	**TFEE**	41.13
Compliance Check	See BREL	**% DFEE < TFEE**			-3.79
% DPER < TPER	50.48	**DPER**	39.24	**TPER**	79.25

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

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

Orientation	East	
Property Tenture	1	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	Flat, Mid-Terrace	
Position of Flat	Mid-floor flat	
Which Floor	4	
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/m²K
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 m²	0.00 m
Ground floor:	1.00 m	69.97 m²	2.52 m
1st Storey:	0.00 m	0.00 m²	0.00 m
2nd Storey:	0.00 m	0.00 m²	0.00 m
3rd Storey:	0.00 m	0.00 m²	0.00 m
4th Storey:	0.00 m	0.00 m²	0.00 m
5th Storey:	0.00 m	0.00 m²	0.00 m
6th Storey:	0.00 m	0.00 m²	0.00 m
7th Storey:	0.00 m	0.00 m²	0.00 m

8.0 Living Area	29.00	m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
EXTERNAL	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	85.60	55.89	0.00	None	29.71	Enter Gross Area
HALLWAY	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.15	70.00	15.32	15.32	0.50	Stairwell Access Corridor 1	0.00	Enter Gross Area

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	69.19	0.00	None	0.00	Enter Gross Area	0.00

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	69.19

Summary for Input Data

elmhurst energy

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	1.10

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Opening	WINDOWS	EXTERNAL	East	10.98	0
Opening	WINDOWS	EXTERNAL	West	10.98	0
Opening	WINDOWS	EXTERNAL	West	7.75	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	11.04	0.30	0.30	No
E3 Sill	Independently assessed	6.70	0.04	0.04	No
E4 Jamb	Independently assessed	47.42	0.05	0.05	No
E7 Party floor between dwellings (in blocks of flats)	Independently assessed	38.92	0.07	0.07	No
E16 Corner (normal)	Independently assessed	2.50	0.09	0.09	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	2.50	-0.09	-0.09	No
E18 Party wall between dwellings	Independently assessed	7.50	0.06	0.06	No
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Independently assessed	5.69	0.00	0.00	No
E14 Flat roof	Independently assessed	22.48	0.04	0.04	No
P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.37	0.12	0.12	No

Y-value	0.06	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	3.00	m³/(h.m²) @ 50 Pa
Property Tested?	Yes	
Test Method	Blower Door	
As Built AP_{50}	0.10	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No

22.0 Lighting

No Fixed Lighting	No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	10	1000	11

24.0 Main Heating 1	Database	
Percentage of Heat	100.00	%
Database Ref. No.	105546	
Fuel Type	Electricity	
SAP Code	0	
In Winter	0.00	
In Summer	0.00	
Model Name	MHC-V6W/D2N8-B	
Manufacturer	Midea	
System Type	Heat Pump	
Controls SAP Code	2207	
Delayed Start Stat	No	
Burner Control	Modulating	
HETAS approved System	No	

Summary for Input Data

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	Underfloor
Underfloor Heating	Yes - Pipes in Wood
Flow Temperature	Enter value
Flow Temperature Value	35.00
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	None

25.0 Main Heating 2 — None

26.0 Heat Networks — 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
Bath Count	1
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	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	2.10	kWh/day
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

None

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 4 - Heatpump	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	85 B	DER	3.74	TER	14.85
Environmental	97 A	% DER < TER			74.81
CO_2 Emissions (t/year)	0.24	DFEE	42.69	TFEE	41.13
Compliance Check	See BREL	% DFEE < TFEE			-3.79
% DPER < TPER	50.48	DPER	39.24	TPER	79.25

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3201 (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) =	0.3201 (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	0.4082	0.4002	0.3922	0.3522	0.3442	0.3041	0.3041	0.2961	0.3201	0.3442	0.3602	0.3762	(22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5649	0.5708	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100	(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428			(33)
Party Floor 1			69.1900			40.0000	2767.6000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 119.6943 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5118 (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	33.9408	33.7526	33.5681	32.7015	32.5394	31.7846	31.7846	31.6448	32.0753	32.5394	32.8674	33.2103	(38)
Heat transfer coeff	93.4527	93.2644	93.0799	92.2133	92.0512	91.2964	91.2964	91.1567	91.5872	92.0512	92.3792	92.7221	(39)

Average = Sum(39)m / 12 = 92.2126

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3356	1.3329	1.3303	1.3179	1.3156	1.3048	1.3048	1.3028	1.3089	1.3156	1.3203	1.3252	(40)
HLP (average)												1.3179	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2454 (42)
Hot water usage for mixer showers

61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305	(42a)

Hot water usage for baths

28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399	(42b)

Hot water usage for other uses

39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054	(42c)

Average daily hot water use (litres/day) 119.1303 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)

Energy content (annual) Total = Sum(45)m = 1978.7239

Distribution loss (46)m = 0.15 x (45)m												
30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(64)

Total per year (kWh/year) = Sum(64)m = 2666.5299 (64)
12Total per year (kWh/year) 2667 (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

114.9845	102.2568	109.8143	99.0817	97.8294	90.0678	90.1552	92.5762	92.3351	100.6940	104.3394	114.0360	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

99.4784	110.1368	99.4784	102.7943	99.4784	102.7943	99.4784	99.4784	102.7943	99.4784	102.7943	99.4784	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

197.2270	199.2736	194.1163	183.1369	169.2773	156.2513	147.5491	145.5025	150.6599	161.6393	175.4988	188.5249	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	(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)

	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159 (71)
Water heating gains (Table 5)												
	154.5491	152.1679	147.5998	137.6135	131.4911	125.0942	121.1764	124.4303	128.2432	135.3414	144.9158	153.2742 (72)
Total internal gains												
	507.9355	518.2593	497.8754	480.2257	456.9278	440.8207	424.8849	426.0922	438.3784	453.1400	479.8899	497.9584 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.9800	19.6403	0.6300	0.7000	0.7700	65.9055 (76)
West	18.7300	19.6403	0.6300	0.7000	0.7700	112.4235 (80)

Solar gains	178.3289	348.8492	574.5050	837.8812	1026.8549	1051.1687	1000.7555	859.6342	668.1730	413.9390	222.3552	146.6490 (83)
Total gains	686.2644	867.1085	1072.3804	1318.1069	1483.7827	1491.9894	1425.6403	1285.7263	1106.5514	867.0790	702.2451	644.6074 (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	24.8938	24.9440	24.9935	25.2284	25.2728	25.4817	25.4817	25.5208	25.4008	25.2728	25.1831	25.0899	
alpha	2.6596	2.6629	2.6662	2.6819	2.6849	2.6988	2.6988	2.7014	2.6934	2.6849	2.6789	2.6727	
util living area													
	0.9337	0.8870	0.8047	0.6653	0.5127	0.3720	0.2751	0.3153	0.5091	0.7636	0.8991	0.9423	(86)
Living	18.7334	19.1938	19.7987	20.4083	20.7639	20.9273	20.9763	20.9654	20.8296	20.2683	19.3845	18.6512	
Non living	17.2319	17.8005	18.5324	19.2424	19.6246	19.7883	19.8264	19.8218	19.7077	19.1155	18.0560	17.1345	
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	19.8405	19.1938	19.7987	20.4083	20.7639	20.9273	20.9763	20.9654	20.8296	20.2683	19.3845	18.9797	(87)
Th 2	19.8130	19.8151	19.8172	19.8268	19.8286	19.8371	19.8371	19.8386	19.8338	19.8286	19.8250	19.8212	(88)
util rest of house													
	0.9230	0.8700	0.7776	0.6249	0.4610	0.3102	0.2049	0.2397	0.4388	0.7211	0.8808	0.9328	(89)
MIT 2	18.7840	17.8005	18.5324	19.2424	19.6246	19.7883	19.8264	19.8218	19.7077	19.1155	18.0560	17.6186	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	19.2219	18.3780	19.0572	19.7256	20.0968	20.2604	20.3030	20.2958	20.1727	19.5933	18.6066	18.1827	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2219	18.3780	19.0572	19.7256	20.0968	20.2604	20.3030	20.2958	20.1727	19.5933	18.6066	18.1827	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9167	0.8448	0.7578	0.6212	0.4733	0.3332	0.2334	0.2700	0.4601	0.7115	0.8571	0.9159	(94)
Useful gains	629.1167	732.5104	812.6038	818.8242	702.2529	497.0651	332.7354	347.1054	509.0940	616.9583	601.9131	590.3686	(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													
	1394.4902	1257.0144	1168.8276	998.2692	772.9313	516.7723	338.0665	355.1275	556.1788	827.8400	1062.9692	1296.5096	(97)
Space heating kWh													
	569.4379	352.4667	265.0305	129.2004	52.5847	0.0000	0.0000	0.0000	0.0000	156.8960	331.9603	525.3689	(98a)
Space heating requirement - total per year (kWh/year)												2382.9455	
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													
	569.4379	352.4667	265.0305	129.2004	52.5847	0.0000	0.0000	0.0000	0.0000	156.8960	331.9603	525.3689	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2382.9455	
Space heating per m2											(98c) / (4) =	34.0567	(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 %)	339.3907	(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													
	569.4379	352.4667	265.0305	129.2004	52.5847	0.0000	0.0000	0.0000	0.0000	156.8960	331.9603	525.3689	(98)
Space heating efficiency (main heating system 1)													
	339.3907	339.3907	339.3907	339.3907	339.3907	0.0000	0.0000	0.0000	0.0000	339.3907	339.3907	339.3907	(210)
Space heating fuel (main heating system)													
	167.7824	103.8528	78.0901	38.0684	15.4939	0.0000	0.0000	0.0000	0.0000	46.2287	97.8107	154.7977	(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												
	263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311 (64)
Efficiency of water heater												289.7382 (216)
(217)m	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382 (217)
Fuel for water heating, kWh/month												
	91.0076	80.5394	85.6408	75.4148	73.2004	66.0582	65.2345	67.7474	68.4117	76.1739	80.8723	90.0230 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678 (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	702.1246 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	289.7382
Water heating fuel used	920.3240 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	155.2231 (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	1777.6717 (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	702.1246	0.1562	109.6903	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	920.3240	0.1408	129.6174	(264)
Space and water heating			239.3077	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			261.7112	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7400	(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	702.1246	1.5783	1108.1667	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	920.3240	1.5208	1399.5994	(278)
Space and water heating			2507.7662	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	155.2231	1.5338	238.0864	(282)
Total Primary energy kWh/year			2745.8526	(286)
Dwelling Primary energy Rate (DPER)			39.2400	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 69.9700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1134	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3634	(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) =	0.3634	(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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3634	0.3907	0.4089	0.4270	(22b)
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5836	0.5912	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			17.4800	1.1450	20.0153			(27)
EXTERNAL	85.6000	17.4800	68.1200	0.1800	12.2616			(29a)
HALLWAY	15.3200		15.3200	0.1800	2.7576			(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109			(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.6454			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 119.6943 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.0500	0.5520
E3 Sill	6.7000	0.0500	0.3350
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0800	1.7984
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.2752	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	50.9206	(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	35.3402	35.0977	34.8599	33.7431	33.5342	32.5615	32.5615	32.3814	32.9362	33.5342	33.9569	34.3988	(38)
Heat transfer coeff	86.2608	86.0182	85.7805	84.6637	84.4548	83.4821	83.4821	83.3020	83.8567	84.4548	84.8775	85.3194	(39)
Average = Sum(39)m / 12 =												84.6627	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2328	1.2294	1.2260	1.2100	1.2070	1.1931	1.1931	1.1905	1.1985	1.2070	1.2131	1.2194	(40)
HLP (average)												1.2100	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2454 (42)

Hot water usage for mixer showers

61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305 (42a)

Hot water usage for baths

26.7283	26.3313	25.7724	24.7417	23.9699	23.1141	22.6519	23.2070	23.8114	24.7271	25.7790	26.6379 (42b)

Hot water usage for other uses

37.6251	36.2569	34.8887	33.5205	32.1524	30.7842	30.7842	32.1524	33.5205	34.8887	36.2569	37.6251 (42c)

Average daily hot water use (litres/day) 116.0258 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	126.2210	123.5261	120.2441	115.2530	111.2000	106.8428	105.1679	108.4358	111.8822	116.4567	121.5247	125.8936	(44)
Energy conte	199.9032	175.8995	184.8107	157.7756	149.6966	131.3756	127.1915	134.2661	137.9620	158.0306	173.1342	197.1189	(45)
Energy content (annual)											Total = Sum(45)m =	1927.1644	
Distribution loss (46)m = 0.15 x (45)m													
	29.9855	26.3849	27.7216	23.6663	22.4545	19.7063	19.0787	20.1399	20.6943	23.7046	25.9701	29.5678	(46)

Water storage loss:

Store volume 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6525 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8924 (55)

Total storage loss

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)

If cylinder contains dedicated solar storage

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
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)
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)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

250.8292	221.8972	235.7367	207.0589	200.6227	180.6589	178.1176	185.1922	187.2453	208.9567	222.4175	248.0450 (62)
-28.2833	-25.0140	-26.1932	-21.6890	-20.2133	-17.2967	-16.2129	-17.2408	-17.8958	-21.0972	-23.9006	-27.7595 (63a)
-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)
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)
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)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

222.5460	196.8833	209.5436	185.3699	180.4094	163.3622	161.9046	167.9514	169.3494	187.8595	198.5169	220.2855 (64)

Total per year (kWh/year) = Sum(64)m = 2263.9816 (64)

12Total per year (kWh/year) 2264 (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

107.2087	95.2848	102.1904	91.8870	90.5150	83.1090	83.0320	85.3843	85.2990	93.2860	96.9937	106.2829 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	112.2698	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

99.4784	110.1368	99.4784	102.7943	99.4784	102.7943	99.4784	99.4784	102.7943	99.4784	102.7943	99.4784 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

197.2270	199.2736	194.1163	183.1369	169.2773	156.2513	147.5491	145.5025	150.6599	161.6393	175.4988	188.5249 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270	34.2270 (69)
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)

Pumps, fans

Losses e.g. evaporation (negative values) (Table 5)

-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159 (71)

Water heating gains (Table 5)

144.0977	141.7928	137.3527	127.6209	121.6599	115.4292	111.6022	114.7639	118.4708	125.3845	134.7135	142.8533 (72)

Total internal gains

500.4840	510.8842	490.6283	473.2330	450.0966	431.1558	415.3106	416.4257	428.6060	446.1831	472.6877	490.5375 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4600	19.6403	0.6300	0.7000	0.7700	38.7750	(76)
West	11.0200	19.6403	0.6300	0.7000	0.7700	66.1456	(80)

Solar gains	104.9206	205.2469	338.0123	492.9708	604.1543	618.4594	588.7986	505.7693	393.1223	243.5427	130.8236	86.2816	(83)
Total gains	605.4046	716.1310	828.6406	966.2038	1054.2509	1049.6152	1004.1092	922.1950	821.7283	689.7258	603.5113	576.8191	(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	26.9693	27.0453	27.1203	27.4780	27.5460	27.8670	27.8670	27.9272	27.7425	27.5460	27.4088	27.2669	
alpha	2.7980	2.8030	2.8080	2.8319	2.8364	2.8578	2.8578	2.8618	2.8495	2.8364	2.8273	2.8178	
util living area													
	0.9468	0.9172	0.8644	0.7603	0.6232	0.4698	0.3524	0.3952	0.6006	0.8210	0.9205	0.9526	(86)
MIT	18.7964	19.1485	19.6570	20.2585	20.6712	20.8943	20.9655	20.9517	20.7817	20.2010	19.4045	18.7452	(87)
Th 2	19.8938	19.8966	19.8993	19.9120	19.9144	19.9255	19.9255	19.9276	19.9212	19.9144	19.9096	19.9045	(88)
util rest of house													
	0.9381	0.9043	0.8437	0.7257	0.5721	0.4018	0.2714	0.3103	0.5309	0.7858	0.9059	0.9448	(89)
MIT 2	17.3602	17.8003	18.4283	19.1533	19.6168	19.8502	19.9086	19.9022	19.7502	19.1106	18.1368	17.3026	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	17.9554	18.3591	18.9376	19.6113	20.0538	20.2829	20.3466	20.3372	20.1777	19.5625	18.6622	17.9005	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9554	18.3591	18.9376	19.6113	20.0538	20.2829	20.3466	20.3372	20.1777	19.5625	18.6622	17.9005	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9180	0.8817	0.8223	0.7152	0.5791	0.4251	0.3038	0.3435	0.5484	0.7727	0.8847	0.9258	(94)
Useful gains	555.7413	631.4344	681.3796	691.0075	610.4650	446.2255	305.0059	316.8027	450.6520	532.9256	533.9060	534.0006	(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													
	1177.9273	1157.7250	1066.9021	906.8597	705.5187	474.4205	312.7752	327.9753	509.6559	756.9261	981.3716	1168.9170	(97)
Space heating kWh													
	462.9064	353.6673	286.8287	155.4136	70.7200	0.0000	0.0000	0.0000	0.0000	166.6564	322.1752	472.3778	(98a)
Space heating requirement - total per year (kWh/year)												2290.7453	
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													
	462.9064	353.6673	286.8287	155.4136	70.7200	0.0000	0.0000	0.0000	0.0000	166.6564	322.1752	472.3778	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2290.7453	
Space heating per m2											(98c) / (4) =	32.7390	(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													
	462.9064	353.6673	286.8287	155.4136	70.7200	0.0000	0.0000	0.0000	0.0000	166.6564	322.1752	472.3778	(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)													
	501.5237	383.1715	310.7570	168.3787	76.6197	0.0000	0.0000	0.0000	0.0000	180.5594	349.0522	511.7853	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	222.5460	196.8833	209.5436	185.3699	180.4094	163.3622	161.9046	167.9514	169.3494	187.8595	198.5169	220.2855	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6633	85.3574	84.7643	83.6672	82.1445	79.8000	79.8000	79.8000	79.8000	83.7923	85.1391	85.7252	(217)
Fuel for water heating, kWh/month													
	259.7916	230.6577	247.2073	221.5563	219.6244	204.7146	202.8880	210.4654	212.2173	224.1967	233.1676	256.9669	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	20.6696	16.5820	14.9302	10.9385	8.4492	6.9031	7.7077	10.0187	13.0133	17.0742	19.2852	21.2441	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.5138	-23.2706	-35.5642	-42.6000	-48.2591	-45.9029	-45.3453	-41.6467	-35.5473	-27.7326	-17.5454	-13.2546	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.9762	-10.7494	-21.9006	-33.6958	-45.3516	-45.8605	-45.3202	-38.0041	-27.3779	-15.6302	-6.7252	-3.9144	(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												2481.8476	(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	2723.4537 (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)	166.8159 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-691.6885 (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	4766.4286 (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	2481.8476	0.2100	521.1880	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2723.4537	0.2100	571.9253	(264)
Space and water heating			1093.1133	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	166.8159	0.1443	24.0767	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-392.1824	0.1333	-52.2797	
PV Unit electricity exported	-299.5061	0.1252	-37.4974	
Total			-89.7771	(269)
Total CO2, kg/year			1039.3421	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.8500	(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	2481.8476	1.1300	2804.4878	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2723.4537	1.1300	3077.5027	(278)
Space and water heating			5881.9904	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	166.8159	1.5338	255.8678	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-392.1824	1.4926	-585.3707	
PV Unit electricity exported	-299.5061	0.4595	-137.6312	
Total			-723.0020	(283)
Total Primary energy kWh/year			5544.9570	(286)
Target Primary Energy Rate (TPER)			79.2500	(287)

Full SAP Calculation Printout

Property Reference	Fortess Road	Issued on Date	02/07/2023
Assessment Reference	Flat 4 - Heatpump	Prop Type Ref	Fortess Road
Property	Flat 1, 7 Fortess Road, LONDON, NW5 1AA		

SAP Rating	85 B	DER	3.74	TER	14.85
Environmental	97 A	% DER < TER			74.81
CO_2 Emissions (t/year)	0.24	DFEE	42.69	TFEE	41.13
Compliance Check	See BREL	% DFEE < TFEE			-3.79
% DPER < TPER	50.48	DPER	39.24	TPER	79.25

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 ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3201 (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) =	0.3201 (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	0.4082	0.4002	0.3922	0.3522	0.3442	0.3041	0.3041	0.2961	0.3201	0.3442	0.3602	0.3762	(22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5649	0.5708	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100	(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428			(33)
Party Floor 1			69.1900			40.0000	2767.6000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 119.6943 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5118 (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	33.9408	33.7526	33.5681	32.7015	32.5394	31.7846	31.7846	31.6448	32.0753	32.5394	32.8674	33.2103	(38)
Heat transfer coeff	93.4527	93.2644	93.0799	92.2133	92.0512	91.2964	91.2964	91.1567	91.5872	92.0512	92.3792	92.7221	(39)
Average = Sum(39)m / 12 =												92.2126	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3356	1.3329	1.3303	1.3179	1.3156	1.3048	1.3048	1.3028	1.3089	1.3156	1.3203	1.3252	(40)
HLP (average)												1.3179	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2454 (42)
Hot water usage for mixer showers

61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305	(42a)

Hot water usage for baths

28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399	(42b)

Hot water usage for other uses

39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054	(42c)

Average daily hot water use (litres/day) 119.1303 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)
Energy content (annual)										Total = Sum(45)m =		1978.7239	

Distribution loss (46)m = 0.15 x (45)m

30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
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)
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)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(62)
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)
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)
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)
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)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(64)

Total per year (kWh/year) = Sum(64)m = 2666.5299 (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

114.9845	102.2568	109.8143	99.0817	97.8294	90.0678	90.1552	92.5762	92.3351	100.6940	104.3394	114.0360	(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	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9734	19.5166	15.8720	12.0161	8.9822	7.5831	8.1938	10.6507	14.2953	18.1512	21.1851	22.5841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.3687	297.4233	289.7258	273.3386	252.6527	233.2109	220.2226	217.1679	224.8655	241.2527	261.9386	281.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	(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)	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	(71)

Water heating gains (Table 5)

	154.5491	152.1679	147.5998	137.6135	131.4911	125.0942	121.1764	124.4303	128.2432	135.3414	144.9158	153.2742 (72)

Total internal gains

	566.5169	564.7335	548.8233	518.5939	488.7517	461.5139	445.2185	447.8746	463.0297	490.3710	523.6652	552.8644 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.9800	19.6403	0.6300	0.7000	0.7700	65.9055 (76)
West	18.7300	19.6403	0.6300	0.7000	0.7700	112.4235 (80)

Solar gains	178.3289	348.8492	574.5050	837.8812	1026.8549	1051.1687	1000.7555	859.6342	668.1730	413.9390	222.3552	146.6490 (83)
Total gains	744.8459	913.5828	1123.3282	1356.4752	1515.6066	1512.6826	1445.9740	1307.5088	1131.2028	904.3100	746.0204	699.5135 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.8938	24.9440	24.9935	25.2284	25.2728	25.4817	25.4817	25.5208	25.4008	25.2728	25.1831	25.0899	
alpha	2.6596	2.6629	2.6662	2.6819	2.6849	2.6988	2.6988	2.7014	2.6934	2.6849	2.6789	2.6727	
util living area	0.9217	0.8756	0.7901	0.6540	0.5044	0.3675	0.2714	0.3105	0.5005	0.7490	0.8868	0.9315	(86)
Living	18.8460	19.2697	19.8596	20.4337	20.7731	20.9295	20.9771	20.9667	20.8366	20.3061	19.4593	18.7605	
Non living	17.3708	17.8920	18.6024	19.2691	19.6330	19.7898	19.8267	19.8225	19.7132	19.1558	18.1456	17.2698	
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	19.8981	19.2697	19.8596	20.4337	20.7731	20.9295	20.9771	20.9667	20.8366	20.3061	19.4593	19.0737	(87)
Th 2	19.8130	19.8151	19.8172	19.8268	19.8286	19.8371	19.8371	19.8386	19.8338	19.8286	19.8250	19.8212	(88)
util rest of house	0.9094	0.8574	0.7620	0.6135	0.4531	0.3063	0.2021	0.2359	0.4308	0.7055	0.8670	0.9206	(89)
MIT 2	18.8394	17.8920	18.6024	19.2691	19.6330	19.7898	19.8267	19.8225	19.7132	19.1558	18.1456	17.7296	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	19.2782	18.4630	19.1235	19.7518	20.1056	20.2622	20.3035	20.2967	20.1788	19.6325	18.6901	18.2867	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2782	18.4630	19.1235	19.7518	20.1056	20.2622	20.3035	20.2967	20.1788	19.6325	18.6901	18.2867	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9030	0.8323	0.7434	0.6107	0.4657	0.3291	0.2303	0.2658	0.4522	0.6973	0.8433	0.9027	(94)
Useful gains	672.5740	760.3853	835.0595	828.3886	705.7484	497.8084	332.9605	347.4951	511.5575	630.6185	629.1473	631.4181	(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	1399.7537	1264.9479	1174.9935	1000.6828	773.7419	516.9344	338.1153	355.2122	556.7434	831.4570	1070.6807	1306.1477	(97)
Space heating kWh	541.0217	339.0661	252.9108	124.0518	50.5871	0.0000	0.0000	0.0000	0.0000	149.4238	317.9040	501.9988	(98a)
Space heating requirement - total per year (kWh/year)												2276.9642	
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	541.0217	339.0661	252.9108	124.0518	50.5871	0.0000	0.0000	0.0000	0.0000	149.4238	317.9040	501.9988	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2276.9642	
Space heating per m2											(98c) / (4) =	32.5420	(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 %)	339.3907	(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	541.0217	339.0661	252.9108	124.0518	50.5871	0.0000	0.0000	0.0000	0.0000	149.4238	317.9040	501.9988	(98)
Space heating efficiency (main heating system 1)	339.3907	339.3907	339.3907	339.3907	339.3907	0.0000	0.0000	0.0000	0.0000	339.3907	339.3907	339.3907	(210)
Space heating fuel (main heating system)	159.4097	99.9044	74.5191	36.5513	14.9053	0.0000	0.0000	0.0000	0.0000	44.0271	93.6691	147.9118	(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
263.6838 233.3535 248.1341 218.5054 212.0894 191.3957 189.0093 196.2902 198.2148 220.7048 234.3178 260.8311 (64)
Efficiency of water heater 289.7382 (216)
(217)m 289.7382 289.7382 289.7382 289.7382 289.7382 289.7382 289.7382 289.7382 289.7382 289.7382 289.7382 289.7382 (217)
Fuel for water heating, kWh/month
91.0076 80.5394 85.6408 75.4148 73.2004 66.0582 65.2345 67.7474 68.4117 76.1739 80.8723 90.0230 (219)
Space cooling fuel requirement
(221)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (221)
Pumps and Fa 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (231)
Lighting 19.2332 15.4296 13.8926 10.1783 7.8621 6.4234 7.1720 9.3225 12.1090 15.8876 17.9450 19.7678 (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 1 670.8977 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 289.7382
Water heating fuel used 920.3240 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 155.2231 (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 1746.4448 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	670.8977	16.4900	110.6310	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	920.3240	16.4900	151.7614	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	155.2231	16.4900	25.5963	(250)
Additional standing charges			0.0000	(251)
Total energy cost			287.9888	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.9018 (257)
SAP value 85.3824
SAP rating (Section 12) 85 (258)
SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	670.8977	0.1562	104.8056	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	920.3240	0.1408	129.6174	(264)
Space and water heating			234.4230	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			256.8265	(272)
CO2 emissions per m2			3.6700	(273)

EI value 97.0066
EI rating 97 (274)
EI band A

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

---
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 69.9700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3201	(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) =	0.3201	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3682	0.3522	0.3522	0.3201	0.3201	0.2801	0.2961	0.2961	0.2961	0.3121	0.3121	0.3442	(22b)
Effective ac	0.5678	0.5620	0.5620	0.5512	0.5512	0.5392	0.5438	0.5438	0.5438	0.5487	0.5487	0.5592	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100	(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428			(33)
Party Floor 1			69.1900			40.0000	2767.6000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		119.6943 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0690 (36)

Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5118 (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	33.0370	32.7015	32.7015	32.0753	32.0753	31.3765	31.6448	31.6448	31.6448	31.9281	31.9281	32.5394	(38)
Heat transfer coeff	92.5488	92.2133	92.2133	91.5872	91.5872	90.8883	91.1567	91.1567	91.1567	91.4399	91.4399	92.0512	(39)
Average = Sum(39)m / 12 =												91.6199	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3227	1.3179	1.3179	1.3089	1.3089	1.2990	1.3028	1.3028	1.3028	1.3068	1.3068	1.3156	(40)
HLP (average)												1.3094	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2454 (42)

Hot water usage for mixer showers

61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305	(42a)

Hot water usage for baths

28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399	(42b)

Hot water usage for other uses

39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054	(42c)

Average daily hot water use (litres/day) 119.1303 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)
Energy content (annual)										Total = Sum(45)m =		1978.7239	

Distribution loss (46)m = 0.15 x (45)m

30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(46)

Water storage loss:
Store volume 200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.1000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.1340 (55)
Total storage loss

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)

If cylinder contains dedicated solar storage

35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(64)

Total per year (kWh/year) = Sum(64)m = 2666.5299 (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

114.9845	102.2568	109.8143	99.0817	97.8294	90.0678	90.1552	92.5762	92.3351	100.6940	104.3394	114.0360	(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	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9734	19.5166	15.8720	12.0161	8.9822	7.5831	8.1938	10.6507	14.2953	18.1512	21.1851	22.5841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.3687	297.4233	289.7258	273.3386	252.6527	233.2109	220.2226	217.1679	224.8655	241.2527	261.9386	281.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	(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)	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	(71)
Water heating gains (Table 5)	154.5491	152.1679	147.5998	137.6135	131.4911	125.0942	121.1764	124.4303	128.2432	135.3414	144.9158	153.2742	(72)
Total internal gains	566.5169	564.7335	548.8233	518.5939	488.7517	461.5139	445.2185	447.8746	463.0297	490.3710	523.6652	552.8644	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East				10.9800	21.5869	0.6300	0.7000	0.7700	72.4378 (76)				
West				18.7300	21.5869	0.6300	0.7000	0.7700	123.5665 (80)				
Solar gains	196.0043	344.0484	567.5417	851.7109	1013.3964	1106.4838	1051.1687	933.2252	723.8340	445.6033	252.3638	158.2444 (83)	
Total gains	762.5212	908.7819	1116.3649	1370.3048	1502.1481	1567.9977	1496.3872	1381.0998	1186.8638	935.9743	776.0290	711.1088 (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	25.1369	25.2284	25.2284	25.4008	25.4008	25.5962	25.5208	25.5208	25.5208	25.4417	25.4417	25.2728	
alpha	2.6758	2.6819	2.6819	2.6934	2.6934	2.7064	2.7014	2.7014	2.7014	2.6961	2.6961	2.6849	
util living area	0.9055	0.8620	0.7591	0.5989	0.4301	0.2611	0.1575	0.1832	0.3913	0.6767	0.8555	0.9173	(86)
Living	19.1367	19.4686	20.0840	20.6043	20.8759	20.9785	20.9966	20.9946	20.9308	20.5515	19.7641	19.0575	
Non living	17.7408	18.1459	18.8779	19.4639	19.7391	19.8314	19.8381	19.8376	19.7979	19.4340	18.5251	17.6479	
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	20.0468	19.4686	20.0840	20.6043	20.8759	20.9785	20.9966	20.9946	20.9308	20.5515	19.7641	19.3292	(87)
Th 2	19.8231	19.8268	19.8268	19.8338	19.8338	19.8416	19.8386	19.8386	19.8386	19.8355	19.8355	19.8286	(88)
util rest of house	0.8901	0.8413	0.7260	0.5525	0.3725	0.1975	0.0875	0.1079	0.3148	0.6212	0.8297	0.9035	(89)
MIT 2	18.9930	18.1459	18.8779	19.4639	19.7391	19.8314	19.8381	19.8376	19.7979	19.4340	18.5251	18.0409	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	19.4297	18.6941	19.3778	19.9366	20.2102	20.3068	20.3183	20.3171	20.2674	19.8971	19.0386	18.5748	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4297	18.6941	19.3778	19.9366	20.2102	20.3068	20.3183	20.3171	20.2674	19.8971	19.0386	18.5748	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8843	0.8176	0.7119	0.5568	0.3915	0.2233	0.1165	0.1391	0.3438	0.6244	0.8086	0.8853	(94)
Useful gains	674.3051	742.9785	794.7933	762.9761	588.1583	350.1327	174.3936	192.1741	407.9954	584.3890	627.5217	629.5365	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W	1298.4353	1189.0107	1067.6295	882.5844	623.7311	355.0863	174.8616	192.9900	425.4686	712.9701	981.9387	1212.7607	(97)
Space heating kWh	464.3528	299.7336	202.9902	86.1180	26.4661	0.0000	0.0000	0.0000	0.0000	95.6643	255.1802	433.9188	(98a)
Space heating requirement - total per year (kWh/year)												1864.4240	
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	464.3528	299.7336	202.9902	86.1180	26.4661	0.0000	0.0000	0.0000	0.0000	95.6643	255.1802	433.9188	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1864.4240	
Space heating per m2											(98c) / (4) =	26.6460	(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 %)												339.2579	(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	464.3528	299.7336	202.9902	86.1180	26.4661	0.0000	0.0000	0.0000	0.0000	95.6643	255.1802	433.9188	(98)
Space heating efficiency (main heating system 1)	339.2579	339.2579	339.2579	339.2579	339.2579	0.0000	0.0000	0.0000	0.0000	339.2579	339.2579	339.2579	(210)
Space heating fuel (main heating system)	136.8731	88.3498	59.8336	25.3842	7.8012	0.0000	0.0000	0.0000	0.0000	28.1981	75.2172	127.9023	(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	263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(64)
Efficiency of water heater												289.8568	(216)
(217)m	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	(217)
Fuel for water heating, kWh/month	90.9704	80.5065	85.6058	75.3839	73.1704	66.0311	65.2078	67.7197	68.3837	76.1427	80.8392	89.9862	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678	(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	549.5595 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	289.8568
Water heating fuel used	919.9474 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	155.2231 (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	1624.7300 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	549.5595	18.3900	101.0640	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	919.9474	18.3900	169.1783	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	155.2231	18.3900	28.5455	(250)
Additional standing charges			0.0000	(251)
Total energy cost			298.7879	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	549.5595	0.1570	86.3013	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	919.9474	0.1408	129.5644	(264)
Space and water heating			215.8657	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			238.2692	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	549.5595	1.5813	869.0229	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	919.9474	1.5208	1399.0268	(278)
Space and water heating			2268.0497	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	155.2231	1.5338	238.0864	(282)
Total Primary energy kWh/year			2506.1361	(286)

SAP 10 EPC IMPROVEMENTS

Flat 4 - Heatpump

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

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

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

Fuel prices for cost data on this page from database revision number 521 TEST (19 Jun 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£299	£299	£0
Space heating	£101	£101	£0
Water heating	£169	£169	£0
Lighting	£29	£29	£0
Total cost of fuels	£299	£299	£0
Total cost of uses	£299	£299	£0
Delivered energy	23 kWh/m²	23 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	36 kWh/m²	36 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

2. Ventilation rate

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

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3201	(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) =	0.3201	(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												
	0.4082	0.4002	0.3922	0.3522	0.3442	0.3041	0.3041	0.2961	0.3201	0.3442	0.3602	0.3762 (22b)
Effective ac	0.5833	0.5801	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5649	0.5708 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)
Flat Roof	69.1900		69.1900	0.1100	7.6109	9.0000	622.7100	(30)
Total net area of external elements Aum(A, m2)			170.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4428			(33)
Party Floor 1			69.1900			40.0000	2767.6000	(32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		119.6943 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0690 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5118 (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	33.9408	33.7526	33.5681	32.7015	32.5394	31.7846	31.7846	31.6448	32.0753	32.5394	32.8674	33.2103	(38)
Heat transfer coeff													
	93.4527	93.2644	93.0799	92.2133	92.0512	91.2964	91.2964	91.1567	91.5872	92.0512	92.3792	92.7221	(39)
Average = Sum(39)m / 12 =												92.2126	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3356	1.3329	1.3303	1.3179	1.3156	1.3048	1.3048	1.3028	1.3089	1.3156	1.3203	1.3252	(40)
HLP (average)												1.3179	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2454 (42)

Hot water usage for mixer showers												
	61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305 (42a)
Hot water usage for baths												
	28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399 (42b)
Hot water usage for other uses												
	39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054 (42c)
Average daily hot water use (litres/day)												119.1303 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)
Energy content (annual)										Total = Sum(45)m =		1978.7239	
Distribution loss (46)m = 0.15 x (45)m													
	30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss													
	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage													
	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(64)
										Total per year (kWh/year) = Sum(64)m =		2666.5299	(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

	114.9845	102.2568	109.8143	99.0817	97.8294	90.0678	90.1552	92.5762	92.3351	100.6940	104.3394	114.0360 (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	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.9734	19.5166	15.8720	12.0161	8.9822	7.5831	8.1938	10.6507	14.2953	18.1512	21.1851	22.5841 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	294.3687	297.4233	289.7258	273.3386	252.6527	233.2109	220.2226	217.1679	224.8655	241.2527	261.9386	281.3804 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178 (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)

	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159 (71)

Water heating gains (Table 5)

	154.5491	152.1679	147.5998	137.6135	131.4911	125.0942	121.1764	124.4303	128.2432	135.3414	144.9158	153.2742 (72)

Total internal gains

	566.5169	564.7335	548.8233	518.5939	488.7517	461.5139	445.2185	447.8746	463.0297	490.3710	523.6652	552.8644 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.9800	19.6403	0.6300	0.7000	0.7700	65.9055	(76)
West	18.7300	19.6403	0.6300	0.7000	0.7700	112.4235	(80)

Solar gains	178.3289	348.8492	574.5050	837.8812	1026.8549	1051.1687	1000.7555	859.6342	668.1730	413.9390	222.3552	146.6490	(83)
Total gains	744.8459	913.5828	1123.3282	1356.4752	1515.6066	1512.6826	1445.9740	1307.5088	1131.2028	904.3100	746.0204	699.5135	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.8938	24.9440	24.9935	25.2284	25.2728	25.4817	25.4817	25.5208	25.4008	25.2728	25.1831	25.0899	
alpha	2.6596	2.6629	2.6662	2.6819	2.6849	2.6988	2.6988	2.7014	2.6934	2.6849	2.6789	2.6727	
util living area	0.9217	0.8756	0.7901	0.6540	0.5044	0.3675	0.2714	0.3105	0.5005	0.7490	0.8868	0.9315	(86)
Living	18.8460	19.2697	19.8596	20.4337	20.7731	20.9295	20.9771	20.9667	20.8366	20.3061	19.4593	18.7605	
Non living	17.3708	17.8920	18.6024	19.2691	19.6330	19.7898	19.8267	19.8225	19.7132	19.1558	18.1456	17.2698	
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	19.8981	19.2697	19.8596	20.4337	20.7731	20.9295	20.9771	20.9667	20.8366	20.3061	19.4593	19.0737	(87)
Th 2	19.8130	19.8151	19.8172	19.8268	19.8286	19.8371	19.8371	19.8386	19.8338	19.8286	19.8250	19.8212	(88)
util rest of house	0.9094	0.8574	0.7620	0.6135	0.4531	0.3063	0.2021	0.2359	0.4308	0.7055	0.8670	0.9206	(89)
MIT 2	18.8394	17.8920	18.6024	19.2691	19.6330	19.7898	19.8267	19.8225	19.7132	19.1558	18.1456	17.7296	(90)
Living area fraction									fLA = Living area / (4) =			0.4145	(91)
MIT	19.2782	18.4630	19.1235	19.7518	20.1056	20.2622	20.3035	20.2967	20.1788	19.6325	18.6901	18.2867	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2782	18.4630	19.1235	19.7518	20.1056	20.2622	20.3035	20.2967	20.1788	19.6325	18.6901	18.2867	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9030	0.8323	0.7434	0.6107	0.4657	0.3291	0.2303	0.2658	0.4522	0.6973	0.8433	0.9027	(94)
Useful gains	672.5740	760.3853	835.0595	828.3886	705.7484	497.8084	332.9605	347.4951	511.5575	630.6185	629.1473	631.4181	(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	1399.7537	1264.9479	1174.9935	1000.6828	773.7419	516.9344	338.1153	355.2122	556.7434	831.4570	1070.6807	1306.1477	(97)
Space heating kWh	541.0217	339.0661	252.9108	124.0518	50.5871	0.0000	0.0000	0.0000	0.0000	149.4238	317.9040	501.9988	(98a)

Space heating requirement - total per year (kWh/year) 2276.9642

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	541.0217	339.0661	252.9108	124.0518	50.5871	0.0000	0.0000	0.0000	0.0000	149.4238	317.9040	501.9988	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2276.9642

Space heating per m2 (98c) / (4) = 32.5420 (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 %)	339.3907 (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													
	541.0217	339.0661	252.9108	124.0518	50.5871	0.0000	0.0000	0.0000	0.0000	149.4238	317.9040	501.9988	(98)
Space heating efficiency (main heating system 1)													
	339.3907	339.3907	339.3907	339.3907	339.3907	0.0000	0.0000	0.0000	0.0000	339.3907	339.3907	339.3907	(210)
Space heating fuel (main heating system)													
	159.4097	99.9044	74.5191	36.5513	14.9053	0.0000	0.0000	0.0000	0.0000	44.0271	93.6691	147.9118	(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													
	263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(64)
Efficiency of water heater												289.7382	(216)
(217)m	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	289.7382	(217)
Fuel for water heating, kWh/month													
	91.0076	80.5394	85.6408	75.4148	73.2004	66.0582	65.2345	67.7474	68.4117	76.1739	80.8723	90.0230	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678	(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	670.8977 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	289.7382
Water heating fuel used	920.3240 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	155.2231 (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	1746.4448 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	670.8977	16.4900	110.6310	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	920.3240	16.4900	151.7614	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	155.2231	16.4900	25.5963	(250)
Additional standing charges			0.0000	(251)
Total energy cost			287.9888	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)

Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9018 (257)
SAP value		85.3824
SAP rating (Section 12)		85 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	670.8977	0.1562	104.8056	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	920.3240	0.1408	129.6174	(264)
Space and water heating			234.4230	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			256.8265	(272)
CO2 emissions per m2			3.6700	(273)
EI value			97.0066	
EI rating			97	(274)
EI band			A	

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		69.9700 (1b)	x	2.5200 (2b)	=	176.3244 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.3244	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1701	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3201	(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) =	0.3201	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.0000	4.0000	3.5000	3.7000	3.7000	3.7000	3.9000	3.9000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0000	1.0000	0.8750	0.9250	0.9250	0.9250	0.9750	0.9750	1.0750	(22a)
Adj infilt rate	0.3682	0.3522	0.3522	0.3201	0.3201	0.2801	0.2961	0.2961	0.2961	0.3121	0.3121	0.3442	(22b)
Effective ac	0.5678	0.5620	0.5620	0.5512	0.5512	0.5392	0.5438	0.5438	0.5438	0.5487	0.5487	0.5592	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
WINDOWS (Uw = 1.10)			29.7100	1.0536	31.3036			(27)
EXTERNAL	85.6000	29.7100	55.8900	0.1500	8.3835	70.0000	3912.3000	(29a)
HALLWAY	15.3200		15.3200	0.1400	2.1448	70.0000	1072.4000	(29a)

Flat Roof	69.1900	69.1900	0.1100	7.6109	9.0000	622.7100 (30)
Total net area of external elements Aum(A, m2)		170.1100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.4428		(33)
Party Floor 1		69.1900			40.0000	2767.6000 (32d)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 8375.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	119.6943 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0400	0.3000	3.3120
E3 Sill	6.7000	0.0400	0.2680
E4 Jamb	47.4200	0.0500	2.3710
E7 Party floor between dwellings (in blocks of flats)	38.9200	0.0700	2.7244
E16 Corner (normal)	2.5000	0.0900	0.2250
E17 Corner (inverted – internal area greater than external area)	2.5000	-0.0900	-0.2250
E18 Party wall between dwellings	7.5000	0.0600	0.4500
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.6900	0.0000	0.0000
E14 Flat roof	22.4800	0.0400	0.8992
P4 Party wall - Roof (insulation at ceiling level)	0.3700	0.1200	0.0444

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0690 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 59.5118 (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	33.0370	32.7015	32.7015	32.0753	32.0753	31.3765	31.6448	31.6448	31.6448	31.9281	31.9281	32.5394	(38)
Heat transfer coeff	92.5488	92.2133	92.2133	91.5872	91.5872	90.8883	91.1567	91.1567	91.1567	91.4399	91.4399	92.0512	(39)
Average = Sum(39)m / 12 =												91.6199	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3227	1.3179	1.3179	1.3089	1.3089	1.2990	1.3028	1.3028	1.3028	1.3068	1.3068	1.3156	(40)
HLP (average)												1.3094	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2454	(42)
Hot water usage for mixer showers	61.8676	60.9378	59.5830	56.9908	55.0778	52.9444	51.7318	53.0764	54.5503	56.8409	59.4888	61.6305	(42a)
Hot water usage for baths	28.1351	27.7172	27.1288	26.0439	25.2315	24.3307	23.8441	24.4284	25.0646	26.0285	27.1358	28.0399	(42b)
Hot water usage for other uses	39.6054	38.1652	36.7250	35.2848	33.8446	32.4044	32.4044	33.8446	35.2848	36.7250	38.1652	39.6054	(42c)
Average daily hot water use (litres/day)												119.1303	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.6080	126.8202	123.4368	118.3194	114.1539	109.6795	107.9803	111.3494	114.8997	119.5944	124.7897	129.2758	(44)
Energy conte	205.2674	180.5903	189.7177	161.9734	153.6730	134.8637	130.5929	137.8738	141.6828	162.2884	177.7858	202.4147	(45)
Energy content (annual)										Total = Sum(45)m =		1978.7239	
Distribution loss (46)m = 0.15 x (45)m	30.7901	27.0885	28.4577	24.2960	23.0510	20.2296	19.5889	20.6811	21.2524	24.3433	26.6679	30.3622	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311	(64)
										Total per year (kWh/year) = Sum(64)m =		2666.5299	(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	114.9845	102.2568	109.8143	99.0817	97.8294	90.0678	90.1552	92.5762	92.3351	100.6940	104.3394	114.0360	(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	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	134.7238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9734	19.5166	15.8720	12.0161	8.9822	7.5831	8.1938	10.6507	14.2953	18.1512	21.1851	22.5841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.3687	297.4233	289.7258	273.3386	252.6527	233.2109	220.2226	217.1679	224.8655	241.2527	261.9386	281.3804	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	50.7178	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	-89.8159	(71)
Water heating gains (Table 5)												
	154.5491	152.1679	147.5998	137.6135	131.4911	125.0942	121.1764	124.4303	128.2432	135.3414	144.9158	153.2742 (72)
Total internal gains												
	566.5169	564.7335	548.8233	518.5939	488.7517	461.5139	445.2185	447.8746	463.0297	490.3710	523.6652	552.8644 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.9800	21.5869	0.6300	0.7000	0.7700	72.4378	(76)
West	18.7300	21.5869	0.6300	0.7000	0.7700	123.5665	(80)

Solar gains	196.0043	344.0484	567.5417	851.7109	1013.3964	1106.4838	1051.1687	933.2252	723.8340	445.6033	252.3638	158.2444 (83)
Total gains	762.5212	908.7819	1116.3649	1370.3048	1502.1481	1567.9977	1496.3872	1381.0998	1186.8638	935.9743	776.0290	711.1088 (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	25.1369	25.2284	25.2284	25.4008	25.4008	25.5962	25.5208	25.5208	25.5208	25.4417	25.4417	25.2728	
alpha	2.6758	2.6819	2.6819	2.6934	2.6934	2.7064	2.7014	2.7014	2.7014	2.6961	2.6961	2.6849	
util living area													
	0.9055	0.8620	0.7591	0.5989	0.4301	0.2611	0.1575	0.1832	0.3913	0.6767	0.8555	0.9173	(86)
Living	19.1367	19.4686	20.0840	20.6043	20.8759	20.9785	20.9966	20.9946	20.9308	20.5515	19.7641	19.0575	
Non living	17.7408	18.1459	18.8779	19.4639	19.7391	19.8314	19.8381	19.8376	19.7979	19.4340	18.5251	17.6479	
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	20.0468	19.4686	20.0840	20.6043	20.8759	20.9785	20.9966	20.9946	20.9308	20.5515	19.7641	19.3292	(87)
Th 2	19.8231	19.8268	19.8268	19.8338	19.8338	19.8416	19.8386	19.8386	19.8386	19.8355	19.8355	19.8286	(88)
util rest of house													
	0.8901	0.8413	0.7260	0.5525	0.3725	0.1975	0.0875	0.1079	0.3148	0.6212	0.8297	0.9035	(89)
MIT 2	18.9930	18.1459	18.8779	19.4639	19.7391	19.8314	19.8381	19.8376	19.7979	19.4340	18.5251	18.0409	(90)
Living area fraction										fLA = Living area / (4) =		0.4145	(91)
MIT	19.4297	18.6941	19.3778	19.9366	20.2102	20.3068	20.3183	20.3171	20.2674	19.8971	19.0386	18.5748	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4297	18.6941	19.3778	19.9366	20.2102	20.3068	20.3183	20.3171	20.2674	19.8971	19.0386	18.5748	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8843	0.8176	0.7119	0.5568	0.3915	0.2233	0.1165	0.1391	0.3438	0.6244	0.8086	0.8853	(94)
Useful gains	674.3051	742.9785	794.7933	762.9761	588.1583	350.1327	174.3936	192.1741	407.9954	584.3890	627.5217	629.5365	(95)
Ext temp.	5.4000	5.8000	7.8000	10.3000	13.4000	16.4000	18.4000	18.2000	15.6000	12.1000	8.3000	5.4000	(96)
Heat loss rate W													
	1298.4353	1189.0107	1067.6295	882.5844	623.7311	355.0863	174.8616	192.9900	425.4686	712.9701	981.9387	1212.7607	(97)
Space heating kWh													
	464.3528	299.7336	202.9902	86.1180	26.4661	0.0000	0.0000	0.0000	0.0000	95.6643	255.1802	433.9188	(98a)
Space heating requirement - total per year (kWh/year)												1864.4240	
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													
	464.3528	299.7336	202.9902	86.1180	26.4661	0.0000	0.0000	0.0000	0.0000	95.6643	255.1802	433.9188	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1864.4240	
Space heating per m2											(98c) / (4) =	26.6460	(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 %)	339.2579	(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													
	464.3528	299.7336	202.9902	86.1180	26.4661	0.0000	0.0000	0.0000	0.0000	95.6643	255.1802	433.9188	(98)
Space heating efficiency (main heating system 1)													
	339.2579	339.2579	339.2579	339.2579	339.2579	0.0000	0.0000	0.0000	0.0000	339.2579	339.2579	339.2579	(210)
Space heating fuel (main heating system)													

	136.8731	88.3498	59.8336	25.3842	7.8012	0.0000	0.0000	0.0000	0.0000	28.1981	75.2172	127.9023 (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

	263.6838	233.3535	248.1341	218.5054	212.0894	191.3957	189.0093	196.2902	198.2148	220.7048	234.3178	260.8311 (64)
Efficiency of water heater												289.8568 (216)
(217)m	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568	289.8568 (217)
Fuel for water heating, kWh/month												
	90.9704	80.5065	85.6058	75.3839	73.1704	66.0311	65.2078	67.7197	68.3837	76.1427	80.8392	89.9862 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	19.2332	15.4296	13.8926	10.1783	7.8621	6.4234	7.1720	9.3225	12.1090	15.8876	17.9450	19.7678 (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	549.5595 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	289.8568
Water heating fuel used	919.9474 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	155.2231 (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	1624.7300 (238)

10a. Fuel costs - using BEDF prices (521)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	549.5595	18.3900	101.0640	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	919.9474	18.3900	169.1783	(247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	155.2231	18.3900	28.5455	(250)
Additional standing charges			0.0000	(251)
Total energy cost			298.7879	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	549.5595	0.1570	86.3013	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	919.9474	0.1408	129.5644	(264)
Space and water heating			215.8657	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	155.2231	0.1443	22.4035	(268)
Total CO2, kg/year			238.2692	(272)

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

	Energy	Primary energy factor	Primary energy

	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	549.5595	1.5813	869.0229 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	919.9474	1.5208	1399.0268 (278)
Space and water heating			2268.0497 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	155.2231	1.5338	238.0864 (282)
Total Primary energy kWh/year			2506.1361 (286)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

3 Fortess Road (2) (2)

As designed

Date: Mon Jul 03 13:30:08 2023

Administrative information

Building Details

Address: SHOP, 3 Fortess Road, Kentish Town, LONDON, NW5 1AA

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 56.67

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	4.75	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	-1.05	
Target primary energy rate (TPER), kWh/m^2.annum	51.67	
Building primary energy rate (BPER), kWh/m^2.annum	-13.6	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF01 SHOP FLOOR/East/Wall-External
Floors	0.18	0.1	0.15	GF02 STAFFROOM/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.11	0.11	GF01 SHOP FLOOR/Roof
Windows** and roof windows	1.6	1.1	1.1	GF01 SHOP FLOOR/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.5	6.5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF01 SHOP FLOOR	242	80	1.875
GF02 STAFFROOM	316	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF01 SHOP FLOOR	YES (+267.8%)	YES
GF02 STAFFROOM	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	56.7	56.7
External area [m^2]	94.7	94.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	22.27	22.08
Average U-value [W/m^2K]	0.24	0.23
Alpha value* [%]	30.33	19.99

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	3.54	4.78
Cooling	16.23	8.73
Auxiliary	0	0
Lighting	11.48	18.42
Hot water	3.05	3.05
Equipment*	46.54	46.54
TOTAL**	**34.29**	**34.97**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	44.17	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*44.17*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	311.07	183.64
Primary energy [kWh/m^2]	-13.6	51.67
Total emissions [kg/m^2]	-1.05	4.75

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	41.5	269.6	3.5	16.2	0	3.26	4.62	3.5	6.5
	Notional	45.4	138.2	4.8	8.7	0	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

5 Fortess Road (2) (2)

As designed

Date: Mon Jul 03 13:31:09 2023

Administrative information

Building Details

Address: SHOP, 5 Fortess Road, Kentish Town, LONDON, NW5 1AA

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 69.49

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	22.86	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	15.99	
Target primary energy rate (TPER), kWh/m^2.annum	247.62	
Building primary energy rate (BPER), kWh/m^2.annum	170.7	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF01 SHOP FLOOR/East/Wall-External
Floors	0.18	0.1	0.13	GF02 STAFFROOM/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.11	0.11	GF01 SHOP FLOOR/Roof
Windows** and roof windows	1.6	1.1	1.1	GF01 SHOP FLOOR/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HEATPUMP

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.5	6.5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
GF03 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF01 SHOP FLOOR	169	80	1.875
GF02 STAFFROOM	716	-	-
GF03 TOILETS	226	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF01 SHOP FLOOR	YES (+285.7%)	YES
GF02 STAFFROOM	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF03 TOILETS	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	69.5	69.5
External area [m^2]	172.3	172.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	39.18	35.24
Average U-value [W/m^2K]	0.23	0.2
Alpha value* [%]	18.95	12.51

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
100	**Restaurants and Cafes/Drinking Establishments/Takeaways**
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	17.93	22.59
Cooling	20.23	17.75
Auxiliary	1.95	2.6
Lighting	19.98	30.98
Hot water	93.39	93.39
Equipment*	123.86	123.86
TOTAL**	**153.47**	**167.29**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	42.02	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*42.02*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	546.57	495.78
Primary energy [kWh/m^2]	170.7	247.62
Total emissions [kg/m^2]	15.99	22.86

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	210.5	336	17.9	20.2	1.9	3.26	4.62	3.5	6.5
	Notional	214.6	281.1	22.6	17.7	2.6	2.64	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

3 Fortess Road (Boiler)

As designed

Date: Mon Jul 03 10:29:49 2023

Administrative information

Building Details

Address: SHOP, 3 Fortess Road, Kentish Town, LONDON, NW5 1AA

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 56.67

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	1.86	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	3.42	
Target primary energy rate (TPER), kWh/m^2.annum	0.75	
Building primary energy rate (BPER), kWh/m^2.annum	19.75	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF01 SHOP FLOOR/East/Wall-External
Floors	0.18	0.1	0.15	GF02 STAFFROOM/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.11	0.11	GF01 SHOP FLOOR/Roof
Windows** and roof windows	1.6	1.1	1.1	GF01 SHOP FLOOR/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Boiler

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF01 SHOP FLOOR	242	80	1.875
GF02 STAFFROOM	316	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF01 SHOP FLOOR	YES (+267.8%)	YES

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	56.7	56.7
External area [m^2]	94.7	94.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	22.27	22.08
Average U-value [W/m^2K]	0.24	0.23
Alpha value* [%]	30.33	19.99

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	14.19	14.71
Cooling	0	0
Auxiliary	2.3	1.09
Lighting	11.48	18.42
Hot water	3.05	3.05
Equipment*	46.54	46.54
TOTAL**	**31.01**	**37.27**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	14.72	33.37
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*14.72*	*33.37*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	311.04	183.78
Primary energy [kWh/m^2]	19.75	0.75
Total emissions [kg/m^2]	3.42	1.86

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	41.5	269.6	14.2	0	2.3	0.81	0	0.91	0
	Notional	45.5	138.2	14.7	0	1.1	0.86	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

5 Fortess Road (Boiler)

As designed

Date: Mon Jul 03 10:31:10 2023

Administrative information

Building Details

Address: SHOP, 5 Fortess Road, Kentish Town, LONDON, NW5 1AA

Certifier details

Name: Mark Simons

Telephone number: 020 8930 5668

Address: 17 Dobree Avenue, London, NW10 2AD

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Lifespan SBEM

Interface to calculation engine version: v6.1.c.0

BRUKL compliance module version: v6.1.c.0

Foundation area [m^2]: 69.49

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	27.25	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	28.87	
Target primary energy rate (TPER), kWh/m^2.annum	216.62	
Building primary energy rate (BPER), kWh/m^2.annum	232.47	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	GF01 SHOP FLOOR/East/Wall-External
Floors	0.18	0.1	0.13	GF02 STAFFROOM/Floor-External
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.11	0.11	GF01 SHOP FLOOR/Roof
Windows** and roof windows	1.6	1.1	1.1	GF01 SHOP FLOOR/East/Wall-External/Glazing
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Boiler

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.

1- Instantaneous

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
GF03 TOILETS	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
GF01 SHOP FLOOR	169	80	1.875
GF02 STAFFROOM	716	-	-
GF03 TOILETS	226	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
GF01 SHOP FLOOR	YES (+285.7%)	YES

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	69.5	69.5
External area [m^2]	172.3	172.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	39.18	35.24
Average U-value [W/m^2K]	0.23	0.2
Alpha value* [%]	18.95	12.51

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
100	**Restaurants and Cafes/Drinking Establishments/Takeaways**
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	69.69	67.17
Cooling	0	0
Auxiliary	5.97	4.51
Lighting	19.98	30.98
Hot water	93.39	93.39
Equipment*	123.86	123.86
TOTAL**	**189.02**	**196.04**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	18.01	33.37
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*18.01*	*33.37*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	539.74	489.1
Primary energy [kWh/m^2]	232.47	216.62
Total emissions [kg/m^2]	28.87	27.25

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	203.7	336	69.7	0	6	0.81	0	0.91	0
	Notional	208	281.1	67.2	0	4.5	0.86	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type