



SUSTAINABILITY STATEMENT & ENERGY STRATEGY



**BUILDING
ENERGY
EXPERTS**



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1. Executive Summary

This Sustainability and Energy Statement has been produced to demonstrate how the proposed development at Land next to 72-74 Gloucester Road, Bristol, BS7 8BF will comply with Bristol City Council Policies:

- BCS13 – Climate Change
- BCS14 – Sustainable Energy (from the Development Framework Core Strategy)
- BCS15 – Sustainable Design and Construction
- BCS16 – Flood Risk and Water Management

The proposed development is for the conversion of an existing building formerly used as a bank into 9 Studio Flats and retaining a portion of the former banking hall as a commercial retail unit. The development includes the selective demolition of part of the building and the construction of a two-storey extension on the site of an existing single storey extension.

Following the methodology outlined in the Climate Change and Sustainability Practice Note, SAP calculations have been completed in line with Part L of the building regulations and the requirements of the BCS to demonstrate a 20% reduction in regulated carbon emissions.

Firstly, SAP calculations to achieve Part L Volume 1 (2021) compliance were modelled in SAP10 to provide 'baseline' energy demand and emissions. Then, additional measures were applied to provide 'residual' energy demand and emissions. Finally, appropriate decentralised renewables were included in the calculations to provide the final energy demand and emissions figures for comparison. More detail is provided in the following sections.

The baseline calculation uses a Gas Combi Boiler for heating and hot water in the baseline building, this is an appropriate selecting for a baseline calculation as it represents a common heating method for domestic buildings in the area and is included in the notional building specification. To summarise the results, the total reduction in carbon emissions for the proposed development is as follows:

Summary of total reduction in carbon emissions

	Before Renewables	After Renewables
Total Target Dwelling Emission Rate (DER)	10,959.77	10,959.77
Total Dwelling Emission Rate (DER)	4,275.49	2,325.06
Total CO₂ Saving on residual energy	60.98%	78.79%
Result	PASS	

2. Bristol City Planning Policy Requirements

Policy BCS13

Development should contribute to both mitigating and adapting to climate change, and to meeting targets to reduce carbon dioxide emissions.

Development should mitigate climate change through measures including:

- High standards of energy efficiency including optimal levels of thermal insulation, passive ventilation and cooling, passive solar design, and the efficient use of natural resources in new buildings.
- The use of decentralised, renewable, and low-carbon energy supply systems.
- Patterns of development which encourage walking, cycling and the use of public transport instead of journeys by private car.

Development should adapt to climate change through measures including:

- Site layouts and approaches to design and construction which provide resilience to climate change.
- Measures to conserve water supplies and minimise the risk and impact of flooding.
- The use of green infrastructure to minimise and mitigate the heating of the urban environment.
- Avoiding responses to climate impacts which lead to increases in energy use and carbon dioxide emissions.

These measures should be integrated into the design of new development.

New development should demonstrate through Sustainability Statements how it would contribute to mitigating and adapting to climate change and to meeting targets to reduce carbon dioxide emissions by means of the above measures.

Policy BCS14

Proposals for the utilisation, distribution, and development of renewable and low carbon sources of energy, including large-scale freestanding installations, will be encouraged. In assessing such proposals, the environmental and economic benefits of the proposed development will be afforded significant weight, alongside considerations of public health and safety and impacts on biodiversity, landscape character, the historic environment and the residential amenity of the surrounding area. Development in Bristol should include measures to reduce carbon dioxide emissions from energy use in accordance with the following energy hierarchy:

1. Minimising energy requirements.
2. Incorporating renewable energy sources.
3. Incorporating low-carbon energy sources.

Consistent with stage two of the above energy hierarchy, development will be expected to provide sufficient renewable energy generation to reduce carbon dioxide emissions from residual energy use

in the buildings by at least 20%. An exception will only be made in the case where a development is appropriate and necessary but where it is demonstrated that meeting the required standard would not be feasible or viable.

The use of combined heat and power (CHP), combined cooling, heat and power (CCHP) and district heating will be encouraged. Within Heat Priority Areas, major development will be expected to incorporate, where feasible, infrastructure for district heating, and will be expected to connect to existing systems where available.

New development will be expected to demonstrate that the heating and cooling systems have been selected according to the following heat hierarchy:

1. Connection to existing CHP/CCHP distribution networks
2. Site-wide renewable CHP/CCHP
3. Site-wide gas-fired CHP/CCHP
4. Site-wide renewable community heating/cooling
5. Site-wide gas-fired community heating

Policy BCS15

Sustainable design and construction will be integral to new development in Bristol. In delivering sustainable design and construction, development should address the following key issues:

- Maximising energy efficiency and integrating the use of renewable and low carbon energy
- Waste and recycling during construction and in operation
- Conserving water resources and minimising vulnerability to flooding
- The type, life cycle and source of materials to be used
- Flexibility and adaptability, allowing future modification of use or layout, facilitating future refurbishment and retrofitting
- Opportunities to incorporate measures which enhance the biodiversity value of development, such as green roofs.

New development will be required to demonstrate as part of the Sustainability Statement submitted with the planning application how the above issues have been addressed. For major developments and development for health or education uses, the Sustainability Statement should include a BREEAM and/or Code for Sustainable Homes assessment. Additionally, in the case of a super-major development, a BREEAM for Communities assessment will be required.

From 2016 residential development will be expected to meet Level 6 of the Code for Sustainable Homes. For non-residential development, also from 2016, a BREEAM “Excellent” rating will be expected.

All new development will be required to provide satisfactory arrangements for the storage of refuse and recyclable materials as an integral part of its design. Major developments should include communal facilities for waste collection and recycling where appropriate.

New homes and workplaces should include the provision of high-speed broadband access and enable provision of Next Generation broadband.

Development in Bristol will follow a sequential approach to flood risk management, giving priority to the development of sites with the lowest risk of flooding. The development of sites with a sequentially greater risk of flooding will be considered where essential for regeneration or where necessary to meet the development requirements of the city.

Development in areas at risk of flooding will be expected to:

- Be resilient to flooding through design and layout, and/or
- Incorporate sensitively designed mitigation measures, which may take the form of on-site flood defence works and/or a contribution towards or a commitment to undertake such off-site measures as may be necessary, in order to ensure that the development remains safe from flooding over its lifetime.

All development will also be expected to incorporate water management measures to reduce surface water run-off and ensure that it does not increase flood risks elsewhere. This should include the use of sustainable drainage systems (SUDS).

3. Climate Change and Sustainable Energy (BCS13 & BCS14)

Design Principles

The proposed development has been designed with a Fabric First approach. The thermal elements in the proposed development meet the minimum requirements set out in Approved Document L Volume 1 (2012) for both new fabric elements and upgraded fabric elements in existing houses.

The new cavity walls, ground floor and flat roof make use of high-performance insulation to achieve U-values significantly lower than the minimum requirements. The fenestration for the flats has been designed to exceed the minimum requirements for new elements. The existing building fabric has been designed to be upgraded in line with the limiting factors in Part L1 for retained elements in existing buildings. The existing walls are specified to receive an internal wall treatment, consisting of an insulated plasterboard. The upgrade of the existing fabric and well specified new thermal elements with low U-values help to reduce energy demand and improve comfort levels within the dwelling. Retaining a large part of the existing building will help to retain much of the existing embodied carbon on site, with the demolition only concerning the flat roof extension to the rear of the property. This flat roof extension is a poor quality in terms of fabric and energy efficiency with poor fabric insulation and contains poor detailing.

It is proposed that the air permeability of each flat is designed and built to achieve a score of 5. The studio flats in the existing building do not require to be air pressure tested, however testing these studio flats will ensure that a target of 5 is achieved by all flats. This will ensure that the flats are using less energy for heating in the winter and therefore reducing the associated carbon output. This air permeability target goes well beyond the requirements of part L for new builds, that sets the maximum air permeability allowed as 8. Testing the studio flats in the existing building would also ensure that they are performing better than the default of 15. The development with the well specified U-values and reduced air permeability would have the potential to reach a reduction of 78.79% in CO₂ emissions over Part L.

The existing commercial unit will be largely retained in the existing building fabric and has received secondary glazing to the existing single glazed windows. The walls are proposed to be dry lined with an internal plasterboard finish and be fitted with new services that will be shared with the studio flats.

The studio flats will be natural ventilated with intermittent extractor fans in the bathrooms and fitted with a cooker hood in the studio kitchens. This will reduce the energy demand of active ventilation systems. The proposed building layout has been determined by several factors, such as ownership and site boundaries, relationship to adjacent buildings, and site access as well as internal walls arrangements. However, the internal room layouts within the resultant footprint have been designed with consideration to recommended zoning and room orientations. With the studio bedroom/Living area being within the southern area of the room/building were possible, the two studio flats with a mezzanine and second floor have the bedrooms/living area in at the top of the building facing south and west.

The studio flats and commercial space have been designed with a shared service specification, this route to heating and water heating has been chosen in line with the heat hierarchy and because of the small footprint in each studio flat. This footprint, efficient building fabric and predicted occupancy

mean each studio flat will have a small heating demand. The building's shared heat network would use air source heat pumps fitted towards the rear of the property to feed the network. Therefore, a shared centralised system for the building will be the most appropriate option to provide a highly efficient and low carbon heating system.

The studio flats have been specified with secondary electric heating, using electric panel heaters in the studio flats to ensure each flat has sufficient heat if required during colder than expected periods.

Renewable energy sources are included in the dwelling in the form of electric air source heat pump for building combined heating and water heating networks and Solar PV for electricity generation.

Careful consideration will be given to the fenestration. Double glazing with Low window U-values will be specified to limit heat loss through the openings. The glazing design allows for passive heating into the building. However, to minimise the risk of overheating within the dwelling, the glazing will be openable where practical and a combination of internal and external shading will be employed. As well as the use of low-e coatings on the glass.

The positioning of the glazed openings will also maximise the available daylight into the building. This will not only improve comfort levels for the occupants but also reduce the energy consumption through artificial lighting.

It is proposed that only energy efficient lighting is installed at the property. This means that all light fittings should have lamps with a luminous efficacy of greater than 45 lamp lumens per circuit-watt and a total output greater than 400 lamp lumens.

Energy Efficiency

The proposed building fabric makes use of high-performance insulation materials in the walls, floors, and lofts. The new and upgrade of the existing building fabric have been designed to limit heat losses and therefore reduce the demand for space heating. The U-values of the building fabric have been calculated and used in the assessment of the dwelling, the achieved U-values are lower than the limiting factors permitted by part L and are substantially less or equal to the U-values used in the notional SAP dwelling.

The proposed dwellings and retail unit achieves an EPC C / EPC B rating with an 78.79% total reduction in CO₂ over the baseline building regulation measures for the development, when renewables and energy efficiency improvements are used. For more information, including details on the specification of the thermal elements and services, please refer to the Energy Strategy.

Decentralised, Renewable and Low-Carbon Energy Supply Systems

The proposal for the dwelling makes use of two low carbon systems, this includes an electric air source heat pump used for heating and water heating only for an entire building heat network. The use of this heat pump provides an efficient system to heat hot water whilst not requiring the need for individual water heaters. Solar PV is also proposed to be added to the building to provide onsite renewable generation. This reduces the associated carbon emissions of the studio flats and the commercial unit.

Proposed Measures for Climate Change Mitigation

The proposed building has been designed to allow for cross ventilation to minimise the need for additional mechanical methods of cooling. Windows have been sized and positioned to allow for good internal daylight and sunlight and allow for solar gains during winter months.

Flood resilience: increased risk from fluvial and tidal flooding as well as localised flooding caused by rainfall is going to be a significant consequence of climate change. The site is within flood zone 1 (low probability of flooding). The risk of potential flooding from rivers and surface water on the site is also in a very low risk area.

Planted / grass areas would be maximised in the front of the two-storey extension, over the existing standing car park to enhance surface water retention. As well have planted features of the terrace over the flat roof.

4. Sustainable Design and Construction

Green Infrastructure and Biodiversity Enhancement

The proposed development consists of an existing dwelling with a two-storey extension built on the site of an existing extension and some hardstanding. The site has little to no existing vegetation, and the proposed scheme would induce some green landscaping with grass and a shrub planting at the front of the property.

Avoiding Responses to Climate Impacts that Lead to Increases in Energy Use and CO₂ Emissions

There are no proposals to include artificial cooling as part of these works in the studio flats. Natural ventilation with cross ventilation and appropriate internal shading, such as blinds and curtains, will be used to mitigate against the effects of overheating from the sun.

Waste and Recycling - During Construction

A Site Waste Management Plan (SWMP) will be developed for this project for the demolition and construction phases of the project. Waste groups to be monitored will be identified and targets set to identify how waste will be reduced, diverted from landfill, reused, or recycled, wherever possible. If waste is unavoidable, it will be disposed of responsibly.

Waste and Recycling - In Operation

Adequate waste and recycling storage will be developed from the existing provision to cater for the proposed residential provision. Both the internal and external provision will comply with the local authorities' recycling and waste collection requirements, ensuring that recyclables and waste can be separated before collection. It is proposed that the house will have designated storage space to hold waste & recycling bins enclosed within the garden.

Building Materials - Type, Life Cycle and Source

All materials specified for the new construction will be at least 'B' rated or higher under the BRE's Green Guide to Specification. This is in line with guidance in the Climate Change and Sustainability Practice Note and will ensure that construction is more sustainable and environmentally friendly. Where feasible, local suppliers of materials will be selected to minimise the environmental impact of transportation. Only suppliers with a certified chain of custody showing responsible sourcing will be used to supply materials, including ensuring that 100% of timber is legally sourced.

Where feasible, the most local suppliers of materials will be selected to minimise the environmental impact of transportation. Only suppliers with a certified chain of custody showing responsible sourcing will be used to supply materials, including ensuring that 100% of timber is legally sourced.

Encouraging Greener Transport Use

Public transport can be easily accessed from the site on Gloucester Road where there is an extensive network of buses that call at various bus stops along the road, including at Sommerville Road bus stop (1 minute's walking distance). Gloucester Road also contains lots of local shops, services, and community facilities all within 5 minutes walking distance. Gloucester Road is also a popular route for cyclists to use heading towards the city centre or Filton Avenue. The site is located within walking distance to local train stations: Montpelier (within 12 min walking distance) and Redland (within 12 min walking distance). These stations connect Clifton with Temple Meads, where services to London, Birmingham, Cardiff and other long-distance services can be caught. Cycle storage provision is included in the proposal for the dwelling.



Figure 1: Site Location within proximity to local services and transport

5. Water Management (BCS16)

Water Conservation Measures

The proposed development will make use of water conservation measures, including internal potable water will be conserved by installing flow restrictors to taps and showers, installing dual flush toilets, and a low-capacity bath.

The following schedule provides a suggested specification proven to exceed building regulations requirements for water conservation (Regulation 36 Compliance).

Table 1 - Water Consumption

Area	Flow Rate / Capacity
Toilet	Dual Flush 6 and 4 Litres
Basin Taps	5 Litres / Minute
Bath	100 Litres (Capacity to Overflow)
Shower	12 Litres / Minute
Kitchen Taps	10 Litres / Minute

Minimising Flood Risk

The site lies within Flood Zone 1 according to the Bristol City Strategic Flood Risk Assessment. See Appendix C for the Environment Agency Flood risk map.

As the works will be built on existing structures and hardstanding, there is unlikely to be any impact on the flood risk of this site. There will be no increase in hardstanding because of these works, with some new planted / grass areas in the front and rear gardens to enhance surface water retention.

6. Design Principles to Reduce Energy Consumption and Carbon Emissions

Fabric

Low U-values and good detailing will help to limit heat losses through the fabric of the proposed development. Where available all non-repeating thermal bridges (e.g. between the external walls and the roofs) will be specified to Enhanced Construction Details. This will ensure that heat losses through these junctions are minimised and that the corresponding psi values can be utilised in the SAP calculations. The dwellings will have designed air permeability of 5, This is below the requirements of the building regulations.

Fenestration and Solar Gain

Careful consideration will be given to the fenestration. Glazing with low window U-values will be specified to limit heat loss through the openings. The glazing design allows for passive heating into the building. However, to minimise the risk of overheating within the dwelling, the glazing will be openable where practical and a combination of internal and external shading will be employed.

Mechanical Services

A well-designed building envelope must be supplemented by appropriate services within the building. Ventilation in the property will be provided by natural ventilation with intermittent extract fans. Space heating and water heating will be provided by ASHPs, with insulated water storage tanks.

Renewables

All possible forms of renewable technologies have been considered for the site. Some systems such as wind turbines are unsuitable for a site that is in a city and has lots of residential properties surrounding it. With the size, form, and spatial requirements for the building the most appropriate renewable source being Solar PV are the most appropriate solutions. Along with heat pumps being used for the heating network.

Overall Performance

The following tables detail how the proposed building has been specified at this stage, incorporating the above principles. Also displayed is how the building performs in relation to the building regulations and the planning requirements for BCS14.

The energy strategy demonstrates how the dwelling will achieve a high fabric performance and proposes the installation of Solar PV to further offset the carbon dioxide emissions associated with the dwellings. There is minimal perceived flood risk, and the dwelling will be specified to achieve a water use target of less than 125 litres per person, per day. The proposed development is therefore judged to comply with all the relevant sustainability and climate change requirements.

7. Selecting Renewables

Table 2 – Feasibility Matrix of Appropriate Renewables

Showing the considerations in choosing a renewable technology for this site.

Solar PV	Water Source heat pump
The available installation area and the orientation around the dwelling make Solar PV a suitable renewable option for the scheme.	Not possible in this location
Solar Thermal	Biomass
The hot water demand and installation area makes it possible to use solar thermal. However, to reach the 20% reduction in carbon emissions, a significant number of panels would be required. It is therefore more space efficient to use Solar PV to reach the 20% reduction.	The proximity of residential dwellings could have an impact on the local air quality for these dwellings. There is not a suitable area for storage or delivery to the building.
Air Source Heat Pump (ASHP)	Combined Heat & Power (CHP)
Appropriate for development, the existing building uses a heat pump for a VRF system where a new modern heat pump will not cause any additional harm to surrounding properties. To be used as part of a building heat network that is shared with all the flats and commercial space in the building.	CHP requires a significant electricity demand which this development does not provide. This makes CHP unviable unless a site-wide community heating system were being proposed.
Ground Source Heat Pump	Wind
The energy demand of the proposed scheme would make it possible to use ground source heat pumps. However, further investigation into external work and the geological setting would be required. The amount of space in the garden is limited and would require bore holes that would be considerably expensive.	The property is within proximity to residential properties therefore, wind is not suitable for this site.
District Heating	
The property is not within an existing district heat network, or in proximity to any planned heat network.	

Table 3 – Feasibility Matrix of Appropriate Renewables

Showing the considerations in choosing a renewable technology for this site.

Technology	Requirements	Requirements Met?	Appropriate?
Photovoltaic panels	Roof facing east to west (through south)	Yes	Yes
	Little/no or modest over shading	Yes	
	Flat roof or pitched roof not greater than 45°	Yes	
	Any size development	Yes	
Solar thermal	All requirements as for photovoltaic panels	Yes	No – Area used for water heating
	Hot water tank	No	
Air source heat pumps	Suitable external wall or other location on-site for equipment	Yes	Yes – for air source heat pumps
	Aesthetic considerations	Yes	
	Noise impact	Yes	
	Any size development	Yes	
Ground source heat pumps	External space for horizontal trench or vertical borehole	Yes	No - Insufficient Land or Space for boreholes
	Medium to large sized development	Yes	
	Archaeology	Unknown	
	Best suited to underfloor heating	No	
Biomass	Space needed for plant, fuel storage and deliveries	Yes	No - Air pollution, Storage Size and delivery location insufficient
	Medium to large sized development	No	
	Minimal impact on residents (air quality, deliveries)	No	
Combined heat and power	Space need for plant access and servicing	No	No

	Large sized development (large heat demand)	No	
District heating	Available network	No	No
	Very large sized development (Substantial heat demand)	No	

Heat Hierarchy

Table 4 – Following the Heat Hierarchy

Showing how the heat hierarchy can be applied to this site.

Stage	Feasible	Notes
1. Connection to existing CHP/CCHP distribution networks	No	No network available
2. Site-wide renewable CHP/CCHP	No	No network available
3. Site-wide gas-fired CHP/CCHP	No	No network available
4. Site-wide renewable community heating/cooling	Yes	Chosen with Air Source Heat pumps as heating source
5. Site-wide gas-fired community heating/cooling	Yes	Not appropriate
6. Individual building renewable heating	Yes	Not appropriate

Feasibility of Appropriate Renewables – Conclusion

The location, size, and type of this development render some renewable technologies appropriate for this site and development proposal.

8. Baseline 'Threshold Values' Fabric and Services Specification

Table 5 – Baseline Compliance (Domestic)

Showing the minimum specification required to achieve compliance with Part L1.

Category	Item	Reference/Source	Value/Details
Building Fabric (W/m²K)	New Cavity Wall	Part L1(A)	0.26
	New Loft Wall	Part L1(B)	0.18
	New Dormer Wall	Part L1(B)	0.18
	Existing Solid Wall	Part L1(B)	0.3
	Existing Solid Wall	Part L2(B)	0.3
	Existing Dormer Wall	Part L1(B)	0.3
	New Flat Roof	Part L1(A)	0.18
	New Dormer Roof	Part L1(B)	0.15
	Existing Sloping Ceiling	Part L1(B)	0.16
	Existing Flat Ceiling	Part L1(B)	0.16
	Existing Dormer Roof	Part L1(B)	0.16
	Internal Walls	Part L1(B)	
	New Ground Floor	Part L1(B)	0.18
	Existing Ground Floor	SBEM Library	0.54
	Existing Ground Floor	Part L1(B)	0.25
Fenestration (W/m²K)	Solid Door	Part L1(B)	1.4
	Glazed Doors/Windows	Part L1(A)	1.6
	Window	Part L1(B)	1.4
Thermal Bridging (y-value)	Accredited and Enhanced Construction Details	Default	Default
Ventilation	Air Permeability (m ³ /hm ²)	Part L1(A)/Assumed L1B/Assumed L2B)	8/15/25
	Mechanical Ventilation	Assumed	n/a
Heating	Primary Heating	Assumed	n/a
	Controls	Assumed	n/a
	Heat Distribution	Assumed	n/a
	Water Heating	Assumed	n/a
	Secondary Heating	Assumed	None
Additional Features	Low Energy Lighting (%)	Assumed	n/a
	SAP Appendix Q	Assumed	None
	Renewables	Assumed	None
	Regulation 36 Compliance (litres/person/day)	Assumed	125

9. Proposed Fabric and Services Specification

Table 6 – Baseline Compliance (Domestic)

Showing the proposed specification that goes above compliance with Part L1B.

Category	Item	Reference/Source	Value/Details
Building Fabric (W/m²K)	New Cavity Wall	Calculated	0.18
	New Loft Wall	Calculated	0.18
	New Dormer Wall	Calculated	0.15
	Existing Solid Wall	Calculated	0.18
	Existing Solid Wall	Calculated	0.18
	Existing Dormer Wall	Calculated	0.15
	New Flat Roof	Calculated	0.13
	New Dormer Roof	Calculated	0.18
	Existing Sloping Ceiling	Calculated	0.15
	Existing Flat Ceiling	Calculated	0.11
	Existing Dormer Roof	Calculated	0.18
	Internal Walls	Calculated	
	New Ground Floor	Calculated	0.14
	Existing Ground Floor	SBEM Library	0.54
	Existing Ground Floor	Part L1(B)	0.14
Fenestration (W/m²K)	Solid Door	Calculated	1.4
	Glazed Doors/Windows	Calculated	1.3
	Window	Calculated	1.4
Thermal Bridging (y-value)	Accredited and Enhanced Construction Details	Default	Default (Existing) / Calculated (New)
Ventilation	Air Permeability (m ³ /hm ²)	Part L1(A)/Assumed L1B/Assumed L2B)	5
	Mechanical Ventilation	Assumed	n/a
Heating	Primary Heating	Assumed	Local Heat Network with Air Source Heat Pump
	Controls	Assumed	Programmers and two room thermostats
	Heat Distribution	Assumed	Radiators
	Water Heating	Assumed	Local Building Heat Network
	Secondary Heating	Assumed	Electric Panel Heaters
Additional Features	Low Energy Lighting (%)	Assumed	n/a
	SAP Appendix Q	Assumed	None
	Renewables	Assumed	None
	Regulation 36 Compliance (litres/person/day)	Assumed	125

Table 7 – Additional Energy Efficiency Measures (Domestic)

Showing updates to the baseline specification to reduce energy demand.

Category	Item	Reference/Source	Value/Details
Network Heating	Controls	Assumed	Charging system linked to use of community heating, programmer and at least two room thermostats.
Network Heating	Distribution Type Space	Assumed	Formal Declaration by Property Developer.
Network Heating	Distribution Loss Space	Assumed	Meets CIBSE Code of Compliance Distribution Loss Given as 1.5.

Table 8 – Proposed Renewables (Domestic)

Showing renewables added to the specification to further reduce carbon emissions.

Total Array Size	Direct/Landlord's Supply	Orientation	Inclination	Overshading
7.02 kWp	Landlords Supply	South	45	None Or Little

Table 9 – Renewables Specification

Category	Item	Reference/Source	Value/Details
Additional Features	Space Heating Network with Air Source Heat Pumps for Space Heating and Water Heating.	Manufacturer	
Additional Features	Solar PV	Developer	7.02 kWp

Table 10 – Summary Table Domestic

	Building Regulations Part L1b compliance ("Baseline" energy demand and emissions)	Proposed scheme after energy efficiency measures and CHP ("Residual" energy demand and emissions)	Proposed scheme after on-site renewables	Proposed scheme offset for financial contribution or other "allowable solution"	Total savings on residual emissions
Energy demand (kWh pa)	20,384.18	13,897.71			
Energy saving achieved (%)		31.82%			
Regulated CO2 emissions (kg pa)	10,959.77	4,275.49	2,325.06		
Saving achieved on residual CO2 emissions (%)		60.98%	45.62%		78.79%
Dwelling Primary Energy Rate (kWh pa)	69,208.18	34,898.26	30,160.92		
Energy saving achieved (%)		49.57%	13.57%		56.42%

Appendix B – SAP Output

Full SAP Calculation Printout



Property Reference	Studio Flat 1			Issued on Date	21/08/2023
Assessment Reference	Baseline	Prop Type Ref	New Flat 01		
Property					
SAP Rating	78 C	DER	29.20	TER	18.16
Environmental	85 B	% DER < TER			-80.79
CO ₂ Emissions (t/year)	0.82	DFEE	59.76	TFEE	42.94
Compliance Check	See BREL	% DFEE < TFEE			-39.16
% DPER < TPER	-71.75	DPER	165.59	TPER	96.41
Assessor Details				Assessor ID	V922-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.5200 (1b)	x 2.4000 (2b)	= 73.2480 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	30.5200		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	73.2480 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.2730 (8)
Pressure Test Method	No
Measured/design AP50	Blower Door
Infiltration rate	15.0000 (17)
Number of sides sheltered	1.0230 (18)
	3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.7929 (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	1.0109	0.9911	0.9713	0.8721	0.8523	0.7532	0.7532	0.7334	0.7929	0.8523	0.8920	0.9316 (22b)
Effective ac	1.0109	0.9911	0.9717	0.8803	0.8632	0.7837	0.7837	0.7689	0.8143	0.8632	0.8978	0.9339 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			4.5800	1.3258	6.0720		(27)
Heatloss Floor 1			30.5200	0.1400	4.2728	110.0000	3357.2000 (28a)
External Wall 1	41.7600	4.5800	37.1800	0.1800	6.6924	150.0000	5577.0000 (29a)
Total net area of external elements A _{um} (A, m ²)			72.2800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.0372		(33)
Party Wall 1			15.9300	0.0000	0.0000	180.0000	2867.4000 (32)
Party Ceiling 1			30.5200			20.0000	610.4000 (32b)
Internal Wall 1			16.8800			9.0000	151.9200 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 12563.9200 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 411.6619 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	1.9100	0.0210	0.0401
E4 Jamb	4.8000	0.0210	0.1008
E5 Ground floor (normal)	17.3900	0.1640	2.8520
E7 Party floor between dwellings (in blocks of flats)	17.3900	0.0440	0.7652
E16 Corner (normal)	7.2000	0.0480	0.3456
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0600	-0.1440
E18 Party wall between dwellings	4.8000	0.0810	0.3888
P1 Party wall - Ground floor	6.6400	0.0800	0.5312
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	6.6400	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.8796 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			21.9168 (37) (33) + (36) + (36a) =

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.4352	23.9571	23.4870	21.2789	20.8658	18.9427	18.9427	18.5866	19.6835	20.8658	21.7015	22.5753 (38)
Average = Sum(39)m / 12 =	46.3520	45.8739	45.4038	43.1957	42.7826	40.8595	40.8595	40.5034	41.6003	42.7826	43.6183	44.4921 (39)
												43.1936
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5187	1.5031	1.4877	1.4153	1.4018	1.3388	1.3388	1.3271	1.3630	1.4018	1.4292	1.4578 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.1834 (42)
Hot water usage for mixer showers	56.4990	55.6499	54.4127	52.0454	50.2984	48.3502	47.2428	48.4707	49.8167	51.9085	54.3266	56.2825 (42a)	
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)	
Hot water usage for other uses	26.7487	25.7760	24.8034	23.8307	22.8580	21.8853	21.8853	22.8580	23.8307	24.8034	25.7760	26.7487 (42c)	
Average daily hot water use (litres/day)												76.4072 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	83.2477	81.4260	79.2160	75.8761	73.1564	70.2355	69.1281	71.3287	73.6474	76.7119	80.1027	83.0312 (44)	
Distribution loss (46)m = 0.15 x (45)m	131.8440	115.9495	121.7521	103.8705	98.4826	86.3627	83.6045	88.3198	90.8146	104.0973	114.1209	130.0068 (45)	
Total = Sum(45)m =	19.7766	17.3924	18.2628	15.5806	14.7724	12.9544	12.5407	13.2480	13.6222	15.6146	17.1181	19.5010 (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	42.4221	37.4782	40.3676	37.4183	37.2797	34.6367	35.2269	36.3483	36.3192	39.0915	39.5027	42.3118 (61)	
Total heat required for water heating calculated for each month	174.2661	153.4277	162.1197	141.2889	135.7622	120.9994	118.8314	124.6681	127.1338	143.1888	153.6236	172.3187 (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	174.2661	153.4277	162.1197	141.2889	135.7622	120.9994	118.8314	124.6681	127.1338	143.1888	153.6236	172.3187 (64)	
12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month	54.4437	47.9228	50.5745	43.8915	42.0654	37.3748	36.6052	38.4534	39.2757	44.3852	47.8209	53.8052 (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	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.5789	58.2124	52.5789	54.3316	52.5789	54.3316	52.5789	52.5789	54.3316	52.5789	54.3316	52.5789 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	98.6222	99.6456	97.0667	91.5765	84.6461	78.1325	73.7810	72.7576	75.3366	80.8267	87.7571	94.2707 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168 (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)	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341 (71)
Water heating gains (Table 5)	73.1770	71.3136	67.9764	60.9605	56.5395	51.9094	49.2006	51.6847	54.5495	59.6576	66.4179	72.3189 (72)
Total internal gains												

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268.1284 272.9219 261.3723 250.6188 237.5148 225.1238 216.3108 217.7716 224.9679 236.8135 252.2569 262.9188 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.5800	10.6334	0.7200	0.7000	0.7700	17.0099 (74)			
Solar gains	17.0099	32.5067	55.2369	88.7246	119.5202	127.9499	119.4576	94.7743	66.4126	38.6950	20.9839	14.1803 (83)
Total gains	285.1382	305.4286	316.6092	339.3434	357.0350	353.0737	335.7684	312.5459	291.3806	275.5085	273.2407	277.0991 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	75.2929	76.0777	76.8654	80.7945	81.5747	85.4141	85.4141	86.1651	83.8932	81.5747	80.0117	78.4405
alpha	6.0195	6.0718	6.1244	6.3863	6.4383	6.6943	6.6943	6.7443	6.5929	6.4383	6.3341	6.2294
util living area	0.9985	0.9972	0.9941	0.9768	0.9076	0.7121	0.5316	0.5886	0.8617	0.9821	0.9965	0.9987 (86)
MIT	19.9110	20.0325	20.2326	20.5694	20.8335	20.9771	20.9971	20.9947	20.9185	20.6067	20.2489	19.9451 (87)
Th 2	19.6735	19.6852	19.6968	19.7516	19.7620	19.8106	19.8106	19.8197	19.7918	19.7620	19.7410	19.7193 (88)
util rest of house	0.9976	0.9957	0.9904	0.9614	0.8502	0.5947	0.3903	0.4421	0.7637	0.9669	0.9941	0.9980 (89)
MIT 2	18.7207	18.8511	19.0589	19.4306	19.6686	19.8039	19.8102	19.8189	19.7595	19.4787	19.1120	18.7916 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.8555 (91)
MIT	19.7390	19.8618	20.0630	20.4049	20.6651	20.8076	20.8256	20.8248	20.7510	20.4437	20.0846	19.7784 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.5890	19.7118	19.9130	20.2549	20.5151	20.6576	20.6756	20.6748	20.6010	20.2937	19.9346	19.6284 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9975	0.9957	0.9912	0.9686	0.8881	0.6802	0.4937	0.5493	0.8338	0.9747	0.9945	0.9979 (94)
Useful gains	284.4268	304.1144	313.8160	328.6957	317.0662	240.1691	165.7552	171.6901	242.9505	268.5308	271.7449	276.5175 (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	708.6754	679.4741	609.0012	490.4811	377.1349	247.5088	166.5264	173.1432	270.4449	414.7213	559.8262	686.4410 (97)
Space heating kWh	315.6410	252.2417	219.6178	116.4855	44.6911	0.0000	0.0000	0.0000	0.0000	108.7658	207.4185	304.9831 (98a)
Space heating requirement - total per year (kWh/year)												1569.8445
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	315.6410	252.2417	219.6178	116.4855	44.6911	0.0000	0.0000	0.0000	0.0000	108.7658	207.4185	304.9831 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1569.8445
Space heating per m2										(98c) / (4) =		51.4366 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												79.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	315.6410	252.2417	219.6178	116.4855	44.6911	0.0000	0.0000	0.0000	0.0000	108.7658	207.4185	304.9831 (98)
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000 (210)
Space heating fuel (main heating system)	359.5910	287.3640	250.1975	132.7050	50.9140	0.0000	0.0000	0.0000	0.0000	123.9104	236.2996	347.4491 (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)	31.5641	25.2242	21.9618	11.6486	4.4691	0.0000	0.0000	0.0000	0.0000	10.8766	20.7419	30.4983 (215)
Water heating												
Water heating requirement	174.2661	153.4277	162.1197	141.2889	135.7622	120.9994	118.8314	124.6681	127.1338	143.1888	153.6236	172.3187 (64)
Efficiency of water heater												75.0000 (216)
(217)m	80.3347	80.1225	79.6908	78.5865	76.8827	75.0000	75.0000	75.0000	75.0000	78.4113	79.6834	80.2844 (217)
Fuel for water heating, kWh/month												

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	216.9251	191.4913	203.4358	179.7877	176.5836	161.3325	158.4418	166.2242	169.5118	182.6124	192.7925	214.6353	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.3488	7.5408	8.3488	8.0795	8.3488	8.0795	8.3488	8.3488	8.0795	8.3488	8.0795	8.3488	(231)
Lighting	10.9249	8.7643	7.8913	5.7815	4.4658	3.6486	4.0739	5.2954	6.8781	9.0245	10.1931	11.2285	(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												1788.4305	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												156.9845	(215)
Efficiency of water heater												75.0000	
Water heating fuel used												2213.7741	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												53.3000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												98.3000	(231)
Electricity for lighting (calculated in Appendix L)												88.1699	(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												4345.6589	(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	1788.4305	0.2100	375.5704 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	156.9845	0.1553	24.3791 (263)
Water heating (other fuel)	2213.7741	0.2100	464.8926 (264)
Space and water heating			864.8420 (265)
Pumps, fans and electric keep-hot	98.3000	0.1387	13.6354 (267)
Energy for lighting	88.1699	0.1443	12.7256 (268)
Total CO2, kg/year			891.2031 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			29.2000 (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	1788.4305	1.1300	2020.9264 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	156.9845	1.5750	247.2452 (277)
Water heating (other fuel)	2213.7741	1.1300	2501.5647 (278)
Space and water heating			4769.7363 (279)
Pumps, fans and electric keep-hot	98.3000	1.5128	148.7082 (281)
Energy for lighting	88.1699	1.5338	135.2379 (282)
Total Primary energy kWh/year			5053.6825 (286)
Dwelling Primary energy Rate (DPER)			165.5900 (287)

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

1. Overall dwelling characteristics

Full SAP Calculation Printout



Ground floor	Area (m2)	Storey height (m)	Volume (m3)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	30.5200 (1b)	x 2.4000 (2b)	= 73.2480 (1b) - (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 73.2480 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour / (5) = 0.2730 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.5230 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4054 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.5168	0.5067	0.4966	0.4459	0.4358	0.3851	0.3851	0.3750	0.4054	0.4358	0.4560	0.4763 (22b)
	0.6336	0.6284	0.6233	0.5994	0.5949	0.5741	0.5741	0.5703	0.5822	0.5949	0.6040	0.6134 (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)			4.5800	1.1450	5.2443		(27)
Heatloss Floor 1			30.5200	0.1300	3.9676		(28a)
External Wall 1	41.7600	4.5800	37.1800	0.1800	6.6924		(29a)
Total net area of external elements Aum(A, m2)			72.2800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.9043		(33)
Party Wall 1			15.9300	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 421.6619 (35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	1.9100	0.0500	0.0955
E4 Jamb	4.8000	0.0500	0.2400
E5 Ground floor (normal)	17.3900	0.1600	2.7824
E7 Party floor between dwellings (in blocks of flats)	17.3900	0.0700	1.2173
E16 Corner (normal)	7.2000	0.0900	0.6480
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E18 Party wall between dwellings	4.8000	0.0600	0.2880
P1 Party wall - Ground floor	6.6400	0.0800	0.5312
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	6.6400	0.0800	0.5312
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.5864 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 21.4907 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	15.3143	15.1889	15.0660	14.4889	14.3809	13.8782	13.8782	13.7851	14.0718	14.3809	14.5993	14.8277 (38)
Average = Sum(39)m / 12 =	36.8050	36.6796	36.5567	35.9796	35.8716	35.3689	35.3689	35.2758	35.5625	35.8716	36.0900	36.3184 (39)
												35.9790
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2059	1.2018	1.1978	1.1789	1.1753	1.1589	1.1589	1.1558	1.1652	1.1753	1.1825	1.1900 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.1834 (42)
Hot water usage for mixer showers	

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Hot water usage for baths	56.4990	55.6499	54.4127	52.0454	50.2984	48.3502	47.2428	48.4707	49.8167	51.9085	54.3266	56.2825 (42a)
Hot water usage for other uses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Average daily hot water use (litres/day)	26.7487	25.7760	24.8034	23.8307	22.8580	21.8853	21.8853	22.8580	23.8307	24.8034	25.7760	26.7487 (42c)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	83.2477	81.4260	79.2160	75.8761	73.1564	70.2355	69.1281	71.3287	73.6474	76.7119	80.1027	83.0312 (44)
Distribution loss (46)m = 0.15 x (45)m	131.8440	115.9495	121.7521	103.8705	98.4826	86.3627	83.6045	88.3198	90.8146	104.0973	114.1209	130.0068 (45)
Water storage loss:	19.7766	17.3924	18.2628	15.5806	14.7724	12.9544	12.5407	13.2480	13.6222	15.6146	17.1181	19.5010 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	42.4221	37.4782	40.3676	37.4183	37.2797	34.6367	35.2269	36.3483	36.3192	39.0915	39.5027	42.3118 (61)
Total heat required for water heating calculated for each month	174.2661	153.4277	162.1197	141.2889	135.7622	120.9994	118.8314	124.6681	127.1338	143.1888	153.6236	172.3187 (62)
WWHRS	-25.8290	-22.8434	-23.9203	-19.8069	-18.4593	-15.7958	-14.8060	-15.7447	-16.3429	-19.2665	-21.8266	-25.3507 (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	148.4372	130.5844	138.1994	121.4819	117.3029	105.2036	104.0253	108.9234	110.7909	123.9223	131.7970	146.9680 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1487.6363 (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	54.4437	47.9228	50.5745	43.8915	42.0654	37.3748	36.6052	38.4534	39.2757	44.3852	47.8209	53.8052 (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	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.5789	58.2124	52.5789	54.3316	52.5789	54.3316	52.5789	52.5789	54.3316	52.5789	54.3316	52.5789 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	98.6222	99.6456	97.0667	91.5765	84.6461	78.1325	73.7810	72.7576	75.3366	80.8267	87.7571	94.2707 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168 (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)	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341 (71)
Water heating gains (Table 5)	73.1770	71.3136	67.9764	60.9605	56.5395	51.9094	49.2006	51.6847	54.5495	59.6576	66.4179	72.3189 (72)
Total internal gains	268.1284	272.9219	261.3723	250.6188	237.5148	225.1238	216.3108	217.7716	224.9679	236.8135	252.2569	262.9188 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				4.5800	10.6334	0.6300	0.7000		0.7700		14.8836 (74)	
Solar gains	14.8836	28.4434	48.3323	77.6340	104.5802	111.9562	104.5254	82.9276	58.1111	33.8581	18.3609	12.4077 (83)
Total gains	283.0120	301.3653	309.7046	328.2528	342.0949	337.0799	320.8362	300.6991	283.0790	270.6717	270.6177	275.3265 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	97.1270	97.4590	97.7866	99.3552	99.6543	101.0706	101.0706	101.3373	100.5203	99.6543	99.0511	98.4282
alpha	7.4751	7.4973	7.5191	7.6237	7.6436	7.7380	7.7380	7.7558	7.7014	7.6436	7.6034	7.5619
util living area	0.9984	0.9968	0.9926	0.9687	0.8729	0.6611	0.4841	0.5376	0.8129	0.9748	0.9958	0.9987 (86)
MIT	20.2489	20.3435	20.4960	20.7337	20.9206	20.9920	20.9993	20.9986	20.9653	20.7521	20.4734	20.2405 (87)
Th 2	20.3970	20.3991	20.4011	20.4106	20.4123	20.4206	20.4206	20.4221	20.4174	20.4123	20.4087	20.4050 (88)
util rest of house	0.9979	0.9960	0.9904	0.9593	0.8406	0.6054	0.4209	0.4711	0.7618	0.9654	0.9944	0.9983 (89)
MIT 2	19.6959	19.7919	19.9451	20.1853	20.3557	20.4165	20.4203	20.4216	20.3969	20.2065	19.9297	19.6942 (90)
Living area fraction	fLA = Living area / (4) =											0.8555 (91)
MIT	20.1690	20.2638	20.4164	20.6544	20.8389	20.9088	20.9157	20.9152	20.8832	20.6733	20.3949	20.1616 (92)

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Temperature adjustment												0.0000
adjusted MIT	20.1690	20.2638	20.4164	20.6544	20.8389	20.9088	20.9157	20.9152	20.8832	20.6733	20.3949	20.1616 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9977	0.9957	0.9905	0.9635	0.8646	0.6525	0.4750	0.5279	0.8033	0.9700	0.9944	0.9981 (94)
Useful gains	282.3621	300.0743	306.7598	316.2585	295.7783	219.9513	152.3847	158.7331	227.3833	262.5398	269.0905	274.8070 (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	584.0579	563.5379	508.7361	422.9198	327.8283	223.1364	152.6402	159.2773	241.2260	361.3441	479.8125	579.6985 (97)
Space heating kWh	224.4617	177.0475	150.2704	76.7961	23.8453	0.0000	0.0000	0.0000	0.0000	73.5104	151.7199	226.8393 (98a)
Space heating requirement - total per year (kWh/year)												1104.4905
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	224.4617	177.0475	150.2704	76.7961	23.8453	0.0000	0.0000	0.0000	0.0000	73.5104	151.7199	226.8393 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1104.4905
Space heating per m2										(98c) / (4) =		36.1891 (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	224.4617	177.0475	150.2704	76.7961	23.8453	0.0000	0.0000	0.0000	0.0000	73.5104	151.7199	226.8393 (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)	242.9239	191.6099	162.6303	83.1127	25.8066	0.0000	0.0000	0.0000	0.0000	79.5567	164.1990	245.4971 (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	148.4372	130.5844	138.1994	121.4819	117.3029	105.2036	104.0253	108.9234	110.7909	123.9223	131.7970	146.9680 (64)
Efficiency of water heater (217)m	85.2650	85.0342	84.5613	83.4258	81.6341	80.3000	80.3000	80.3000	80.3000	83.3004	84.6839	80.3000 (216)
Fuel for water heating, kWh/month	174.0892	153.5668	163.4311	145.6167	143.6935	131.0132	129.5459	135.6456	137.9712	148.7656	155.6340	172.2794 (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	10.9249	8.7643	7.8913	5.7815	4.4658	3.6486	4.0739	5.2954	6.8781	9.0245	10.1931	11.2285 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.9946	-21.5201	-31.5117	-36.1641	-39.6961	-37.3895	-37.0108	-34.6391	-30.4958	-25.0195	-16.6502	-12.9260 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-7.3491	-15.5776	-31.1518	-47.0339	-62.3833	-62.6754	-61.8571	-52.2175	-38.1221	-22.2663	-9.8161	-5.7961 (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												1195.3361 (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												1791.2523 (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)												88.1699 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-754.2637 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)

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Appendix Q - special features

Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2406.4946 (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	1195.3361	0.2100	251.0206 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1791.2523	0.2100	376.1630 (264)
Space and water heating			627.1836 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	88.1699	0.1443	12.7256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-338.0175	0.1341	-45.3388
PV Unit electricity exported	-416.2462	0.1258	-52.3530
Total			-97.6917 (269)
Total CO2, kg/year			554.1467 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.1600 (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	1195.3361	1.1300	1350.7298 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1791.2523	1.1300	2024.1151 (278)
Space and water heating			3374.8449 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	88.1699	1.5338	135.2379 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-338.0175	1.4957	-505.5730
PV Unit electricity exported	-416.2462	0.4617	-192.1702
Total			-697.7433 (283)
Total Primary energy kWh/year			2942.4403 (286)
Target Primary Energy Rate (TPER)			96.4100 (287)

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Property Reference	Studio Flat 1				Issued on Date	21/08/2023
Assessment Reference	Proposed		Prop Type Ref	New Flat 01		
Property						
SAP Rating	77 C	DER	5.23	TER	17.84	
Environmental	97 A	% DER < TER				70.88
CO ₂ Emissions (t/year)	0.14	DFEE	42.36	TFEE	42.04	
Compliance Check	See BREL	% DFEE < TFEE				1.37
% DPER < TPER	42.55	DPER	54.41	TPER	94.71	
Assessor Details					Assessor ID	V922-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.5200 (1b)	x 2.4000 (2b)	= 73.2480 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	30.5200		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 73.2480 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.2730 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	5.0000 (17)
Number of sides sheltered	0.5230 (18)
	3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4054 (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	0.5168	0.5067	0.4966	0.4459	0.4358	0.3851	0.3851	0.3750	0.4054	0.4358	0.4560	0.4763 (22b)
Effective ac	0.6336	0.6284	0.6233	0.5994	0.5949	0.5741	0.5741	0.5703	0.5822	0.5949	0.6040	0.6134 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.30)			4.5800	1.2357	5.6597		(27)
Heatloss Floor 1			30.5200	0.1400	4.2728	110.0000	3357.2000 (28a)
External Wall 1	41.7600	4.5800	37.1800	0.1800	6.6924	150.0000	5577.0000 (29a)
Total net area of external elements A _{um} (A, m ²)			72.2800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.6249		(33)
Party Wall 1			15.9300	0.0000	0.0000	180.0000	2867.4000 (32)
Party Ceiling 1			30.5200			20.0000	610.4000 (32b)
Internal Wall 1			16.8800			9.0000	151.9200 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 12563.9200 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 411.6619 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	1.9100	0.0210	0.0401
E4 Jamb	4.8000	0.0210	0.1008
E5 Ground floor (normal)	17.3900	0.1640	2.8520
E7 Party floor between dwellings (in blocks of flats)	17.3900	0.0440	0.7652
E16 Corner (normal)	7.2000	0.0480	0.3456
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0600	-0.1440
E18 Party wall between dwellings	4.8000	0.0810	0.3888
P1 Party wall - Ground floor	6.6400	0.0800	0.5312
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	6.6400	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.8796 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	21.5045 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	15.3143	15.1889	15.0660	14.4889	14.3809	13.8782	13.8782	13.7851	14.0718	14.3809	14.5993	14.8277 (38)
Average = Sum(39)m / 12 =	36.8188	36.6934	36.5706	35.9934	35.8854	35.3827	35.3827	35.2896	35.5764	35.8854	36.1039	36.3323 (39)
												35.9929
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2064	1.2023	1.1982	1.1793	1.1758	1.1593	1.1593	1.1563	1.1657	1.1758	1.1830	1.1904 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.1834 (42)
Hot water usage for mixer showers	56.4990	55.6499	54.4127	52.0454	50.2984	48.3502	47.2428	48.4707	49.8167	51.9085	54.3266	56.2825 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	26.7487	25.7760	24.8034	23.8307	22.8580	21.8853	21.8853	22.8580	23.8307	24.8034	25.7760	26.7487 (42c)
Average daily hot water use (litres/day)												76.4072 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	83.2477	81.4260	79.2160	75.8761	73.1564	70.2355	69.1281	71.3287	73.6474	76.7119	80.1027	83.0312 (44)
Distribution loss (46)m = 0.15 x (45)m	131.8440	115.9495	121.7521	103.8705	98.4826	86.3627	83.6045	88.3198	90.8146	104.0973	114.1209	130.0068 (45)
Water storage loss:	19.7766	17.3924	18.2628	15.5806	14.7724	12.9544	12.5407	13.2480	13.6222	15.6146	17.1181	19.5010 (46)
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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	187.1208	165.8769	177.0289	157.3642	153.7594	139.8564	138.8813	143.5966	144.3082	159.3741	167.6146	185.2837 (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	187.1208	165.8769	177.0289	157.3642	153.7594	139.8564	138.8813	143.5966	144.3082	159.3741	167.6146	185.2837 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1920.0650 (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	88.0596	78.4951	84.7040	77.3319	76.9669	71.5105	72.0199	73.5878	72.9908	78.8338	80.7401	87.4487 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	52.5789	58.2124	52.5789	54.3316	52.5789	54.3316	52.5789	52.5789	54.3316	52.5789	54.3316	52.5789 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	98.6222	99.6456	97.0667	91.5765	84.6461	78.1325	73.7810	72.7576	75.3366	80.8267	87.7571	94.2707 (68)
	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168 (69)

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Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341 (71)
Water heating gains (Table 5)	118.3596	116.8083	113.8495	107.4054	103.4501	99.3202	96.8010	98.9083	101.3761	105.9594	112.1391	117.5386 (72)
Total internal gains	310.3111	315.4165	304.2453	294.0637	281.4254	272.5346	263.9112	264.9952	271.7945	280.1154	294.9781	305.1385 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.5800	10.6334	0.7200	0.7000	0.7700	17.0099 (74)			
Solar gains	17.0099	32.5067	55.2369	88.7246	119.5202	127.9499	119.4576	94.7743	66.4126	38.6950	20.9839	14.1803 (83)
Total gains	327.3209	347.9232	359.4822	382.7883	400.9456	400.4845	383.3688	359.7695	338.2071	318.8104	315.9619	319.3188 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	94.7879	95.1118	95.4313	96.9616	97.2534	98.6350	98.6350	98.8952	98.0982	97.2534	96.6649	96.0573
util living area	7.3192	7.3408	7.3621	7.4641	7.4836	7.5757	7.5757	7.5930	7.5399	7.4836	7.4443	7.4038
	0.9953	0.9915	0.9808	0.9305	0.7876	0.5621	0.4058	0.4506	0.7068	0.9392	0.9879	0.9960 (86)
MIT	20.3327	20.4323	20.5894	20.8162	20.9584	20.9969	20.9998	20.9995	20.9851	20.8290	20.5609	20.3239 (87)
Th 2	19.9149	19.9182	19.9214	19.9366	19.9394	19.9527	19.9527	19.9551	19.9476	19.9394	19.9337	19.9277 (88)
util rest of house	0.9930	0.9871	0.9708	0.8975	0.7160	0.4720	0.3094	0.3486	0.6089	0.9029	0.9808	0.9940 (89)
MIT 2	19.1746	19.3028	19.5008	19.7770	19.9139	19.9517	19.9526	19.9551	19.9414	19.7988	19.4779	19.1738 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.8555 (91)
MIT	20.1653	20.2691	20.4321	20.6661	20.8075	20.8459	20.8485	20.8486	20.8343	20.6802	20.4044	20.1577 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1653	20.2691	20.4321	20.6661	20.8075	20.8459	20.8485	20.8486	20.8343	20.6802	20.4044	20.1577 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9936	0.9887	0.9761	0.9214	0.7755	0.5491	0.3919	0.4359	0.6922	0.9299	0.9844	0.9945 (94)
Ext temp.	325.2292	344.0077	350.8980	352.6876	310.9313	219.8942	150.2462	156.8260	234.1010	296.4535	311.0355	317.5740 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	584.1422	563.9437	509.5059	423.5011	326.8250	220.9969	150.3222	156.9891	239.5812	361.7314	480.3391	579.7786 (97)
Space heating requirement - total per year (kWh/year)	192.6313	147.7971	118.0043	50.9857	11.8249	0.0000	0.0000	0.0000	0.0000	48.5668	121.8986	195.0802 (98a)
Solar heating kWh												886.7888
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	192.6313	147.7971	118.0043	50.9857	11.8249	0.0000	0.0000	0.0000	0.0000	48.5668	121.8986	195.0802 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												886.7888
Space heating per m2										(98c) / (4) =		29.0560 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (301)
Fraction of space heat from community system												0.9000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating:												
Space heating requirement	192.6313	147.7971	118.0043	50.9857	11.8249	0.0000	0.0000	0.0000	0.0000	48.5668	121.8986	195.0802 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	260.0523	199.5260	159.3059	68.8307	15.9636	0.0000	0.0000	0.0000	0.0000	65.5651	164.5631	263.3582
Space heating requirement	260.0523	199.5260	159.3059	68.8307	15.9636	0.0000	0.0000	0.0000	0.0000	65.5651	164.5631	263.3582 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												100.0000 (308)
Space heating fuel for secondary/supplementary system	19.2631	14.7797	11.8004	5.0986	1.1825	0.0000	0.0000	0.0000	0.0000	4.8567	12.1899	19.5080 (309)

Water heating
Annual water heating requirement

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	187.1208	165.8769	177.0289	157.3642	153.7594	139.8564	138.8813	143.5966	144.3082	159.3741	167.6146	185.2837 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	280.6812	248.8154	265.5433	236.0463	230.6390	209.7846	208.3219	215.3949	216.4624	239.0611	251.4219	277.9255
Water heating fuel												
	280.6812	248.8154	265.5433	236.0463	230.6390	209.7846	208.3219	215.3949	216.4624	239.0611	251.4219	277.9255 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
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 (331)
Lighting	10.9249	8.7643	7.8913	5.7815	4.4658	3.6486	4.0739	5.2954	6.8781	9.0245	10.1931	11.2285 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-14.9530	-21.0515	-29.9195	-33.1844	-35.5840	-33.1883	-32.8697	-30.9850	-27.7660	-23.7208	-16.3993	-12.9684 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1197.1649 (307)
Space heating fuel - secondary												88.6789 (309)
Water heating fuel - community heating												2880.0975 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												11.9716 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (331)
Electricity for lighting (calculated in Appendix L)												88.1699 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-312.5899 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3941.5213 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1164.9321	0.1565	53.5228 (367)
Electrical energy for heat distribution (space & water)	11.9716	0.0000	5.9233 (372)
Overall CO2 factor for heat network			0.0430 (386)
Total CO2 associated with community systems			175.1598 (373)
Space heating - secondary	88.6789	0.1565	13.8763 (374)
Space and water heating			189.0360 (376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (378)
Energy for lighting	88.1699	0.1443	12.7256 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-312.5899	0.1348	-42.1308
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-42.1308 (380)
Total CO2, kg/year			159.6309 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.2300 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1164.9321	1.5793	540.2043 (467)
Electrical energy for heat distribution (space & water)	11.9716	0.0000	62.6831 (472)
Overall CO2 factor for heat network			0.4546 (486)
Total CO2 associated with community systems			1853.6283 (473)
Space heating - secondary	88.6789	1.5793	140.0530 (374)
Space and water heating			1993.6813 (476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (478)
Energy for lighting	88.1699	1.5338	135.2379 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-312.5899	1.4981	-468.3018
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-468.3018 (480)
Total Primary energy kWh/year			1660.6174 (483)
Dwelling Primary energy Rate (DPER)			54.4100 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	30.5200 (1b)	x 2.4000 (2b)	= 73.2480 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	30.5200		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 73.2480 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.2730 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.5230 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4054 (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	0.5168	0.5067	0.4966	0.4459	0.4358	0.3851	0.3851	0.3750	0.4054	0.4358	0.4560	0.4763 (22b)
Effective ac	0.6336	0.6284	0.6233	0.5994	0.5949	0.5741	0.5741	0.5703	0.5822	0.5949	0.6040	0.6134 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			4.5800	1.1450	5.2443		(27)
Heatloss Floor 1			30.5200	0.1300	3.9676		(28a)
External Wall 1	41.7600	4.5800	37.1800	0.1800	6.6924		(29a)
Total net area of external elements Aum(A, m ²)			72.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.9043		(33)
Party Wall 1			15.9300	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 421.6619 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	1.9100	0.0500	0.0955
E4 Jamb	4.8000	0.0500	0.2400
E5 Ground floor (normal)	17.3900	0.1600	2.7824
E7 Party floor between dwellings (in blocks of flats)	17.3900	0.0700	1.2173
E16 Corner (normal)	7.2000	0.0900	0.6480
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E18 Party wall between dwellings	4.8000	0.0600	0.2880
P1 Party wall - Ground floor	6.6400	0.0800	0.5312
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	6.6400	0.0800	0.5312
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.5864 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss		(33) + (36) + (36a) =	21.4907 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	15.3143	15.1889	15.0660	14.4889	14.3809	13.8782	13.8782	13.7851	14.0718	14.3809	14.5993	14.8277 (38)
Heat transfer coeff	36.8050	36.6796	36.5567	35.9796	35.8716	35.3689	35.3689	35.2758	35.5625	35.8716	36.0900	36.3184 (39)
Average = Sum(39)m / 12 =												35.9790

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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HLP	1.2059	1.2018	1.1978	1.1789	1.1753	1.1589	1.1589	1.1558	1.1652	1.1753	1.1825	1.1900 (40)
HLP (average)												1.1789
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.1834 (42)
Hot water usage for mixer showers	56.4990	55.6499	54.4127	52.0454	50.2984	48.3502	47.2428	48.4707	49.8167	51.9085	54.3266	56.2825 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	26.7487	25.7760	24.8034	23.8307	22.8580	21.8853	21.8853	22.8580	23.8307	24.8034	25.7760	26.7487 (42c)
Average daily hot water use (litres/day)												76.4072 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	83.2477	81.4260	79.2160	75.8761	73.1564	70.2355	69.1281	71.3287	73.6474	76.7119	80.1027	83.0312 (44)
Energy content (annual)	131.8440	115.9495	121.7521	103.8705	98.4826	86.3627	83.6045	88.3198	90.8146	104.0973	114.1209	130.0068 (45)
Distribution loss (46)m = 0.15 x (45)m												1269.2252
Water storage loss:	19.7766	17.3924	18.2628	15.5806	14.7724	12.9544	12.5407	13.2480	13.6222	15.6146	17.1181	19.5010 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	178.4389	158.0352	168.3470	148.9624	145.0775	131.4546	130.1994	134.9147	135.9064	150.6922	159.2128	176.6018 (62)
WHRHS	-25.8290	-22.8434	-23.9203	-19.8069	-18.4593	-15.7958	-14.8060	-15.7447	-16.3429	-19.2665	-21.8266	-25.3507 (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	152.6099	135.1918	144.4267	129.1555	126.6181	115.6588	115.3933	119.1700	119.5635	131.4257	137.3861	151.2511 (64)
12Total per year (kWh/year)												1577.8505 (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	81.1141	72.2218	77.7585	70.6104	70.0214	64.7891	65.0744	66.6423	66.2693	71.8883	74.0187	80.5032 (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	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676	59.1676 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.5789	58.2124	52.5789	54.3316	52.5789	54.3316	52.5789	52.5789	54.3316	52.5789	54.3316	52.5789 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	98.6222	99.6456	97.0667	91.5765	84.6461	78.1325	73.7810	72.7576	75.3366	80.8267	87.7571	94.2707 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168	28.9168 (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)	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341	-47.3341 (71)
Water heating gains (Table 5)	109.0243	107.4729	104.5141	98.0700	94.1147	89.9848	87.4656	89.5729	92.0407	96.6240	102.8037	108.2032 (72)
Total internal gains	303.9757	309.0811	297.9100	287.7284	275.0901	263.1992	254.5759	255.6598	262.4591	273.7800	288.6427	298.8032 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.5800	10.6334	0.6300	0.7000	0.7700	14.8836 (74)			
Solar gains	14.8836	28.4434	48.3323	77.6340	104.5802	111.9562	104.5254	82.9276	58.1111	33.8581	18.3609	12.4077 (83)
Total gains	318.8593	337.5245	346.2423	365.3624	379.6702	375.1553	359.1012	338.5873	320.5702	307.6381	307.0036	311.2109 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	97.1270	97.4590	97.7866	99.3552	99.6543	101.0706	101.0706	101.3373	100.5203	99.6543	99.0511	98.4282
alpha	7.4751	7.4973	7.5191	7.6237	7.6436	7.7380	7.7380	7.7558	7.7014	7.6436	7.6034	7.5619
util living area	0.9964	0.9935	0.9855	0.9458	0.8197	0.5985	0.4330	0.4784	0.7401	0.9505	0.9906	0.9970 (86)
MIT	20.3285	20.4225	20.5725	20.7963	20.9492	20.9959	20.9997	20.9994	20.9815	20.8169	20.5520	20.3205 (87)
Th 2	20.3970	20.3991	20.4011	20.4106	20.4123	20.4206	20.4206	20.4221	20.4174	20.4123	20.4087	20.4050 (88)
util rest of house	0.9955	0.9917	0.9815	0.9314	0.7827	0.5464	0.3762	0.4188	0.6866	0.9346	0.9877	0.9962 (89)
MIT 2	19.7750	19.8702	20.0200	20.2430	20.3775	20.4185	20.4205	20.4219	20.4070	20.2660	20.0072	19.7739 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	20.2485	20.3427	20.4927	20.7163	20.8666	20.9124	20.9160	20.9159	20.8985	20.7373	20.4733	20.2415 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.2485	20.3427	20.4927	20.7163	20.8666	20.9124	20.9160	20.9159	20.8985	20.7373	20.4733	20.2415 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9952	0.9916	0.9822	0.9393	0.8117	0.5907	0.4248	0.4698	0.7311	0.9439	0.9881	0.9959 (94)
Useful gains	317.3294	334.6769	340.0725	343.1755	308.1965	221.6166	152.5347	159.0586	234.3678	290.3764	303.3463	309.9401 (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	586.9835	566.4318	511.5255	425.1460	328.8205	223.2637	152.6519	159.3025	241.7714	363.6412	482.6420	582.6027 (97)
Space heating kWh	200.6226	155.7393	127.5610	59.0187	15.3442	0.0000	0.0000	0.0000	0.0000	54.5090	129.0929	202.8610 (98a)
Space heating requirement - total per year (kWh/year)												944.7488
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	200.6226	155.7393	127.5610	59.0187	15.3442	0.0000	0.0000	0.0000	0.0000	54.5090	129.0929	202.8610 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												944.7488
Space heating per m2												(98c) / (4) = 30.9551 (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	200.6226	155.7393	127.5610	59.0187	15.3442	0.0000	0.0000	0.0000	0.0000	54.5090	129.0929	202.8610 (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)	217.3593	168.7316	138.2026	63.9423	16.6243	0.0000	0.0000	0.0000	0.0000	59.0564	139.8623	219.7844 (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	152.6099	135.1918	144.4267	129.1555	126.6181	115.6588	115.3933	119.1700	119.5635	131.4257	137.3861	151.2511 (64)
Efficiency of water heater (217)m	84.6742	84.3779	83.7825	82.4199	80.6839	79.8000	79.8000	79.8000	79.8000	82.2437	83.9204	79.8000 (216)
Fuel for water heating, kWh/month	180.2320	160.2218	172.3830	156.7041	156.9311	144.9358	144.6032	149.3358	149.8289	159.8004	163.7101	178.5329 (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	10.9249	8.7643	7.8913	5.7815	4.4658	3.6486	4.0739	5.2954	6.8781	9.0245	10.1931	11.2285 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-14.9946	-21.5201	-31.5117	-36.1641	-39.6961	-37.3895	-37.0108	-34.6391	-30.4958	-25.0195	-16.6502	-12.9260 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-7.3491	-15.5776	-31.1518	-47.0339	-62.3833	-62.6754	-61.8571	-52.2175	-38.1221	-22.2663	-9.8161	-5.7961 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	1023.5632 (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	1917.2192 (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)	88.1699 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-754.2637 (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	2360.6886 (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	1023.5632	0.2100	214.9483 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1917.2192	0.2100	402.6160 (264)
Space and water heating			617.5643 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	88.1699	0.1443	12.7256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-338.0175	0.1341	-45.3388
PV Unit electricity exported	-416.2462	0.1258	-52.3530
Total			-97.6917 (269)
Total CO2, kg/year			544.5275 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.8400 (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	1023.5632	1.1300	1156.6264 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1917.2192	1.1300	2166.4577 (278)
Space and water heating			3323.0841 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	88.1699	1.5338	135.2379 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-338.0175	1.4957	-505.5730
PV Unit electricity exported	-416.2462	0.4617	-192.1702
Total			-697.7433 (283)
Total Primary energy kWh/year			2890.6796 (286)
Target Primary Energy Rate (TPER)			94.7100 (287)

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Property Reference	Studio Flat 2				Issued on Date	21/08/2023
Assessment Reference	Baseline	Prop Type Ref		Existing 02		
Property						
SAP Rating	71 C	DER	50.92	TER	25.36	
Environmental	79 C	% DER < TER				-100.79
CO ₂ Emissions (t/year)	1	DFEE	126.52	TFEE	54.36	
Compliance Check	See BREL	% DFEE < TFEE				-132.74
% DPER < TPER	-111.28	DPER	287.38	TPER	136.02	
Assessor Details					Assessor ID	V922-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	21.0800 (1b)	x 4.3200 (2b)	= 91.0656 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	21.0800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 91.0656 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c)	Air changes per hour
Pressure test	20.0000 / (5) = 0.2196 (8)
Pressure Test Method	No
Measured/design AP50	Blower Door
Infiltration rate	15.0000 (17)
Number of sides sheltered	0.9696 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8242 (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	1.0508	1.0302	1.0096	0.9066	0.8860	0.7830	0.7830	0.7624	0.8242	0.8860	0.9272	0.9684 (22b)
Effective ac	1.0508	1.0302	1.0096	0.9110	0.8925	0.8065	0.8065	0.7906	0.8396	0.8925	0.9299	0.9689 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			1.6200	1.3258	2.1477		(27)
Heatloss Floor 1			21.0800	0.2500	5.2700	110.0000	2318.8000 (28a)
External Wall 1	32.2600	1.6200	30.6400	0.3000	9.1920	17.0000	520.8800 (29a)
Total net area of external elements A _{um} (A, m ²)			53.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.6097		(33)
Party Wall 1			32.2600	0.0000	0.0000	180.0000	5806.8000 (32)
Party Ceiling 1			21.0800			20.0000	421.6000 (32b)
Internal Wall 1			36.9700			9.0000	332.7300 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 9400.8100 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 445.9587 (35)
 Thermal bridges (Default value 0.200 * total exposed area) 10.6680 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 27.2777 (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	31.5791	30.9599	30.3407	27.3758	26.8208	24.2373	24.2373	23.7588	25.2324	26.8208	27.9435	29.1173 (38)
Heat transfer coeff	58.8568	58.2376	57.6184	54.6535	54.0986	51.5150	51.5150	51.0366	52.5101	54.0986	55.2213	56.3950 (39)
Average = Sum(39)m / 12 =												54.6464
HLP	2.7921	2.7627	2.7333	2.5927	2.5663	2.4438	2.4438	2.4211	2.4910	2.5663	2.6196	2.6753 (40)
HLP (average)												2.5923
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0407 (42)
Hot water usage for mixer showers												
	53.4165	52.6138	51.4440	49.2059	47.5542	45.7123	44.6653	45.8262	47.0988	49.0765	51.3627	53.2119 (42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses												
	25.2880	24.3684	23.4489	22.5293	21.6097	20.6902	20.6902	21.6097	22.5293	23.4489	24.3684	25.2880 (42c)
Average daily hot water use (litres/day)												72.2373 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	78.7045	76.9822	74.8929	71.7352	69.1639	66.4024	65.3555	67.4359	69.6281	72.5253	75.7311	78.4998 (44)
Energy conte	124.6487	109.6216	115.1075	98.2019	93.1079	81.6495	79.0418	83.4998	85.8584	98.4162	107.8928	122.9118 (45)
Energy content (annual)												1199.9579
Distribution loss (46)m = 0.15 x (45)m												
	18.6973	16.4432	17.2661	14.7303	13.9662	12.2474	11.8563	12.5250	12.8788	14.7624	16.1839	18.4368 (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	40.1069	35.4329	38.1646	35.3763	35.2452	32.7464	33.3044	34.3646	34.3371	36.9581	37.3468	40.0027 (61)
Total heat required for water heating calculated for each month												
	164.7556	145.0545	153.2721	133.5781	128.3531	114.3959	112.3462	117.8644	120.1955	135.3743	145.2396	162.9144 (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	164.7556	145.0545	153.2721	133.5781	128.3531	114.3959	112.3462	117.8644	120.1955	135.3743	145.2396	162.9144 (64)
Total per year (kWh/year) = Sum(64)m =												1633.3439 (64)
12Total per year (kWh/year)												1633 (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	51.4724	45.3074	47.8144	41.4962	39.7697	35.3351	34.6075	36.3548	37.1322	41.9629	45.2111	50.8688 (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	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	47.8221	52.9459	47.8221	49.4162	47.8221	49.4162	47.8221	47.8221	49.4162	47.8221	49.4162	47.8221 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	77.9684	78.7775	76.7386	72.3982	66.9192	61.7697	58.3296	57.5205	59.5593	63.8997	69.3787	74.5282 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036 (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)												
	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287 (71)
Water heating gains (Table 5)												
	69.1834	67.4217	64.2667	57.6336	53.4539	49.0765	46.5155	48.8640	51.5725	56.4018	62.7931	68.3721 (72)
Total internal gains	236.5846	240.7558	230.4381	221.0587	209.8059	198.8731	191.2778	192.8173	199.1587	209.7343	223.1988	232.3331 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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North		1.6200		10.6334		0.7200		0.7000		0.7700		6.0166 (74)	
Solar gains	6.0166	11.4980	19.5379	31.3829	42.2757	45.2574	42.2536	33.5228	23.4909	13.6869	7.4222	5.0157	(83)
Total gains	242.6012	252.2538	249.9761	252.4416	252.0816	244.1305	233.5314	226.3401	222.6496	223.4212	230.6210	237.3488	(84)
7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1 (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.3676	44.8393	45.3212	47.7798	48.2700	50.6908	50.6908	51.1660	49.7301	48.2700	47.2886	46.3044	
alpha	3.9578	3.9893	4.0214	4.1853	4.2180	4.3794	4.3794	4.4111	4.3153	4.2180	4.1526	4.0870	
util living area	0.9970	0.9961	0.9945	0.9889	0.9722	0.9131	0.8018	0.8298	0.9490	0.9876	0.9952	0.9974	(86)
MIT	19.0360	19.1759	19.4359	19.8879	20.3011	20.7073	20.8919	20.8710	20.5880	20.0738	19.5503	19.0953	(87)
Th 2	18.8576	18.8733	18.8893	18.9675	18.9825	19.0539	19.0539	19.0674	19.0261	18.9825	18.9523	18.9211	(88)
util rest of house	0.9951	0.9935	0.9904	0.9789	0.9393	0.7880	0.5238	0.5743	0.8673	0.9737	0.9914	0.9957	(89)
MIT 2	17.2266	17.3766	17.6466	18.1486	18.5568	18.9523	19.0427	19.0505	18.8472	18.3435	17.8048	17.3296	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.5227	18.6655	18.9283	19.3945	19.8063	20.2095	20.3673	20.3546	20.0941	19.5830	19.0551	18.5944	(92)
Temperature adjustment													
adjusted MIT	18.3727	18.5155	18.7783	19.2445	19.6563	20.0595	20.2173	20.2046	19.9441	19.4330	18.9051	18.4444	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9945	0.9929	0.9901	0.9808	0.9538	0.8668	0.7126	0.7479	0.9160	0.9780	0.9913	0.9952	(94)
Useful gains	241.2685	250.4644	247.4984	247.5844	240.4322	211.6044	166.4163	169.2766	203.9477	218.5116	228.6194	236.2003	(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	828.2768	792.9322	707.4568	565.3650	430.4239	281.2445	186.3465	194.1716	306.8771	477.8516	651.8938	803.3125	(97)
Space heating kWh	436.7341	364.5383	342.2090	228.8020	141.3539	0.0000	0.0000	0.0000	0.0000	192.9490	304.7576	421.9315	(98a)
Space heating requirement - total per year (kWh/year)													2433.2754
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	436.7341	364.5383	342.2090	228.8020	141.3539	0.0000	0.0000	0.0000	0.0000	192.9490	304.7576	421.9315	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													2433.2754
Space heating per m2	(98c) / (4) =											115.4305 (99)	
9a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11)													
Fraction of space heat from main system(s)													0.1000 (201)
Efficiency of main space heating system 1 (in %)													0.9000 (202)
Efficiency of main space heating system 2 (in %)													79.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (207)
													100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	436.7341	364.5383	342.2090	228.8020	141.3539	0.0000	0.0000	0.0000	0.0000	192.9490	304.7576	421.9315	(98)
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000	(210)
Space heating fuel (main heating system)	497.5452	415.2968	389.8584	260.6606	161.0361	0.0000	0.0000	0.0000	0.0000	219.8153	347.1921	480.6814	(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)	43.6734	36.4538	34.2209	22.8802	14.1354	0.0000	0.0000	0.0000	0.0000	19.2949	30.4758	42.1931	(215)
Water heating													
Water heating requirement	164.7556	145.0545	153.2721	133.5781	128.3531	114.3959	112.3462	117.8644	120.1955	135.3743	145.2396	162.9144	(64)
Efficiency of water heater	81.1247	81.0193	80.7790	80.2128	79.2254	75.0000	75.0000	75.0000	75.0000	79.8048	80.6495	75.0000	(216)
Fuel for water heating, kWh/month	203.0893	179.0369	189.7426	166.5297	162.0101	152.5279	149.7950	157.1525	160.2607	169.6317	180.0875	200.9329	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.5268	4.0888	4.5268	4.3808	4.5268	4.3808	4.5268	4.5268	4.3808	4.5268	4.3808	4.5268	(231)
Lighting	9.9365	7.9714	7.1774	5.2585	4.0618	3.3185	3.7053	4.8163	6.2559	8.2080	9.2710	10.2126	(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)

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

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

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

1. Overall dwelling characteristics

2. Ventilation rate

Full SAP Calculation Printout



	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2196 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4696	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3992 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.5090	0.4990	0.4890	0.4391	0.4291	0.3792	0.3792	0.3692	0.3992	0.4291	0.4491	0.4690	(22b)
	0.6295	0.6245	0.6196	0.5964	0.5921	0.5719	0.5719	0.5682	0.5797	0.5921	0.6008	0.6100	(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)			1.6200	1.1450	1.8550		(27)
Heatloss Floor 1			21.0800	0.1300	2.7404		(28a)
External Wall 1	32.2600	1.6200	30.6400	0.1800	5.5152		(29a)
Total net area of external elements Aum(A, m2)			53.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.1106		(33)
Party Wall 1			32.2600	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							455.9587 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							2.6670 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	12.7776 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	18.9180	18.7669	18.6187	17.9229	17.7927	17.1867	17.1867	17.0744	17.4201	17.7927	18.0561	18.3314	(38)
Average = Sum(39)m / 12 =	31.6956	31.5444	31.3963	30.7005	30.5703	29.9642	29.9642	29.8520	30.1977	30.5703	30.8336	31.1090	(39)
													30.6998
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.5036	1.4964	1.4894	1.4564	1.4502	1.4215	1.4215	1.4161	1.4325	1.4502	1.4627	1.4758	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0407 (42)
Hot water usage for mixer showers													
	53.4165	52.6138	51.4440	49.2059	47.5542	45.7123	44.6653	45.8262	47.0988	49.0765	51.3627	53.2119	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	25.2880	24.3684	23.4489	22.5293	21.6097	20.6902	20.6902	21.6097	22.5293	23.4489	24.3684	25.2880	(42c)
Average daily hot water use (litres/day)													72.2373 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	78.7045	76.9822	74.8929	71.7352	69.1639	66.4024	65.3555	67.4359	69.6281	72.5253	75.7311	78.4998	(44)
Energy conte	124.6487	109.6216	115.1075	98.2019	93.1079	81.6495	79.0418	83.4998	85.8584	98.4162	107.8928	122.9118	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													1199.9579
	18.6973	16.4432	17.2661	14.7303	13.9662	12.2474	11.8563	12.5250	12.8788	14.7624	16.1839	18.4368	(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	40.1069	35.4329	38.1646	35.3763	35.2452	32.7464	33.3044	34.3646	34.3371	36.9581	37.3468	40.0027	(61)
Total heat required for water heating calculated for each month													
	164.7556	145.0545	153.2721	133.5781	128.3531	114.3959	112.3462	117.8644	120.1955	135.3743	145.2396	162.9144	(62)

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WVHRS	-24.4198	-21.5971	-22.6152	-18.7263	-17.4522	-14.9340	-13.9982	-14.8857	-15.4513	-18.2154	-20.6358	-23.9676 (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	140.3358	123.4574	130.6569	114.8518	110.9009	99.4620	98.3480	102.9787	104.7442	117.1589	124.6038	138.9468 (64)
Total per year (kWh/year) = Sum(64)m =												1406.4453 (64)
12Total per year (kWh/year)												
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	51.4724	45.3074	47.8144	41.4962	39.7697	35.3351	34.6075	36.3548	37.1322	41.9629	45.2111	50.8688 (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	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.8221	52.9459	47.8221	49.4162	47.8221	49.4162	47.8221	47.8221	49.4162	47.8221	49.4162	47.8221 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	77.9684	78.7775	76.7386	72.3982	66.9192	61.7697	58.3296	57.5205	59.5593	63.8997	69.3787	74.5282 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036 (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)	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287 (71)
Water heating gains (Table 5)	69.1834	67.4217	64.2667	57.6336	53.4539	49.0765	46.5155	48.8640	51.5725	56.4018	62.7931	68.3721 (72)
Total internal gains	236.5846	240.7558	230.4381	221.0587	209.8059	198.8731	191.2778	192.8173	199.1587	209.7343	223.1988	232.3331 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North			1.6200		10.6334		0.6300		0.7000		0.7700		5.2645 (74)	
Solar gains			5.2645	10.0608	17.0957	27.4601	36.9912	39.6002	36.9719	29.3325	20.5546	11.9760	6.4945	4.3888 (83)
Total gains			241.8491	250.8166	247.5338	248.5188	246.7972	238.4733	228.2497	222.1498	219.7133	221.7103	229.6932	236.7219 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	84.2355	84.6391	85.0385	86.9659	87.3362	89.1027	89.1027	89.4377	88.4139	87.3362	86.5902	85.8238
alpha	6.6157	6.6426	6.6692	6.7977	6.8224	6.9402	6.9402	6.9625	6.8943	6.8224	6.7727	6.7216
util living area	0.9969	0.9953	0.9921	0.9775	0.9249	0.7620	0.5721	0.6097	0.8490	0.9725	0.9932	0.9973 (86)
MIT	20.1458	20.2340	20.3776	20.6171	20.8330	20.9699	20.9963	20.9944	20.9348	20.6950	20.4032	20.1482 (87)
Th 2	20.2482	20.2518	20.2553	20.2718	20.2749	20.2893	20.2893	20.2919	20.2837	20.2749	20.2687	20.2621 (88)
util rest of house	0.9960	0.9939	0.9894	0.9692	0.8969	0.6935	0.4827	0.5202	0.7924	0.9608	0.9907	0.9965 (89)
MIT 2	19.4639	19.5548	19.7004	19.9494	20.1533	20.2741	20.2882	20.2901	20.2460	20.0283	19.7373	19.4780 (90)
Living area fraction	19.9523	20.0413	20.1855	20.4276	20.6402	20.7725	20.7954	20.7946	fLA = Living area / (4) =	20.7394	20.5059	20.2143
MIT	19.9523	20.0413	20.1855	20.4276	20.6402	20.7725	20.7954	20.7946	20.7394	20.5059	20.2143	19.9581 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9523	20.0413	20.1855	20.4276	20.6402	20.7725	20.7954	20.7946	20.7394	20.5059	20.2143	19.9581 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9956	0.9934	0.9891	0.9712	0.9120	0.7412	0.5468	0.5843	0.8300	0.9650	0.9905	0.9961 (94)
Ext temp.	240.7757	249.1533	244.8425	241.3718	225.0905	176.7503	124.8037	129.7939	182.3604	213.9559	227.5132	235.8007 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	496.1097	477.6250	429.6731	353.9038	273.3030	184.9549	125.7114	131.1870	200.4947	302.8246	404.3624	490.2168 (97)
Space heating requirement - total per year (kWh/year)	189.9685	153.5330	137.5139	81.0230	35.8702	0.0000	0.0000	0.0000	0.0000	66.1184	127.3314	189.2856 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	189.9685	153.5330	137.5139	81.0230	35.8702	0.0000	0.0000	0.0000	0.0000	66.1184	127.3314	189.2856 (98c)

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Space heating requirement after solar contribution - total per year (kWh/year)
Space heating per m²

(98c) / (4) = 980.6439
46.5201 (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	189.9685	153.5330	137.5139	81.0230	35.8702	0.0000	0.0000	0.0000	0.0000	66.1184	127.3314	189.2856 (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)	205.5936	166.1612	148.8246	87.6872	38.8205	0.0000	0.0000	0.0000	0.0000	71.5567	137.8046	204.8545 (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	140.3358	123.4574	130.6569	114.8518	110.9009	99.4620	98.3480	102.9787	104.7442	117.1589	124.6038	138.9468 (64)
Efficiency of water heater	85.0309	84.8497	84.4913	83.6472	82.2444	80.3000	80.3000	80.3000	80.3000	83.2037	84.4279	80.3000 (216)
Fuel for water heating, kWh/month	165.0410	145.5013	154.6396	137.3051	134.8430	123.8630	122.4757	128.2424	130.4411	140.8097	147.5861	163.3816 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	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	9.9365	7.9714	7.1774	5.2585	4.0618	3.3185	3.7053	4.8163	6.2559	8.2080	9.2710	10.2126 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-10.7323	-15.5999	-23.1318	-26.8991	-29.8426	-28.2414	-27.9825	-26.0547	-22.7093	-18.3251	-11.9967	-9.2313 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-4.7004	-10.0233	-20.1496	-30.5653	-40.6631	-40.8729	-40.3050	-33.9367	-24.6847	-14.3350	-6.2834	-3.7001 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1061.3029 (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												1694.1297 (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)												80.1931 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-520.9659 (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												2400.6598 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	1061.3029	0.2100	222.8736 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1694.1297	0.2100	355.7672 (264)
Space and water heating			578.6408 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	80.1931	0.1443	11.5743 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-250.7465	0.1338	-33.5624
PV Unit electricity exported	-270.2194	0.1257	-33.9550
Total			-67.5173 (269)

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Total CO₂, kg/year
EPC Target Carbon Dioxide Emission Rate (TER)

534.6271 (272)
25.3600 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	1061.3029	1.1300	1199.2723 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1694.1297	1.1300	1914.3665 (278)
Space and water heating			3113.6388 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	80.1931	1.5338	123.0029 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-250.7465	1.4946	-374.7768
PV Unit electricity exported	-270.2194	0.4612	-124.6363
Total			-499.4131 (283)
Total Primary energy kWh/year			2867.3295 (286)
Target Primary Energy Rate (TPER)			136.0200 (287)

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Property Reference	Studio Flat 2				Issued on Date	21/08/2023
Assessment Reference	Proposed	Prop Type Ref		Existing 02		
Property						
SAP Rating	72 C	DER	8.81	TER	25.17	
Environmental	96 A	% DER < TER			65.00	
CO ₂ Emissions (t/year)	0.17	DFEE	79.28	TFEE	54.36	
Compliance Check	See BREL	% DFEE < TFEE			-45.85	
% DPER < TPER	32.10	DPER	91.65	TPER	134.98	
Assessor Details					Assessor ID	V922-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	21.0800 (1b)	x 4.3200 (2b)	= 91.0656 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	21.0800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 91.0656 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c)	Air changes per hour
Pressure test	20.0000 / (5) = 0.2196 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	5.0000 (17)
Number of sides sheltered	0.4696 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3992 (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	0.5090	0.4990	0.4890	0.4391	0.4291	0.3792	0.3792	0.3692	0.3992	0.4291	0.4491	0.4690 (22b)
Effective ac	0.6295	0.6245	0.6196	0.5964	0.5921	0.5719	0.5719	0.5682	0.5797	0.5921	0.6008	0.6100 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			1.6200	1.3258	2.1477		(27)
Heatloss Floor 1			21.0800	0.1400	2.9512	110.0000	2318.8000 (28a)
External Wall 1	32.2600	1.6200	30.6400	0.1800	5.5152	17.0000	520.8800 (29a)
Total net area of external elements A _{um} (A, m ²)			53.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.6141		(33)
Party Wall 1			32.2600	0.0000	0.0000	180.0000	5806.8000 (32)
Party Ceiling 1			21.0800			20.0000	421.6000 (32b)
Internal Wall 1			36.9700			9.0000	332.7300 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 9400.8100 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 445.9587 (35)
 Thermal bridges (Default value 0.200 * total exposed area) 10.6680 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 21.2821 (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	18.9180	18.7669	18.6187	17.9229	17.7927	17.1867	17.1867	17.0744	17.4201	17.7927	18.0561	18.3314 (38)
Heat transfer coeff	40.2001	40.0490	39.9009	39.2050	39.0748	38.4688	38.4688	38.3565	38.7022	39.0748	39.3382	39.6135 (39)
Average = Sum(39)m / 12 =												39.2044
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.9070	1.8999	1.8928	1.8598	1.8536	1.8249	1.8249	1.8196	1.8360	1.8536	1.8661	1.8792 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0407 (42)
Hot water usage for mixer showers												
53.4165	52.6138	51.4440	49.2059	47.5542	45.7123	44.6653	45.8262	47.0988	49.0765	51.3627	53.2119 (42a)	
Hot water usage for baths												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)	
Hot water usage for other uses												
25.2880	24.3684	23.4489	22.5293	21.6097	20.6902	20.6902	21.6097	22.5293	23.4489	24.3684	25.2880 (42c)	
Average daily hot water use (litres/day)												72.2373 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	78.7045	76.9822	74.8929	71.7352	69.1639	66.4024	65.3555	67.4359	69.6281	72.5253	75.7311	78.4998 (44)
Energy content (annual)	124.6487	109.6216	115.1075	98.2019	93.1079	81.6495	79.0418	83.4998	85.8584	98.4162	107.8928	122.9118 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1199.9579
18.6973	16.4432	17.2661	14.7303	13.9662	12.2474	11.8563	12.5250	12.8788	14.7624	16.1839	18.4368 (46)	
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	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 (61)	
Total heat required for water heating calculated for each month												
179.9255	159.5490	170.3843	151.6955	148.3848	135.1432	134.3186	138.7766	139.3521	153.6930	161.3865	178.1886 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	179.9255	159.5490	170.3843	151.6955	148.3848	135.1432	134.3186	138.7766	139.3521	153.6930	161.3865	178.1886 (64)
								Total per year (kWh/year) = Sum(64)m =				1850.7976 (64)
12Total per year (kWh/year)												1851 (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												
85.6671	76.3911	82.4947	75.4471	75.1798	69.9434	70.5028	71.9851	71.3429	76.9448	78.6693	85.0896 (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	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	47.8221	52.9459	47.8221	49.4162	47.8221	49.4162	47.8221	47.8221	49.4162	47.8221	49.4162	47.8221 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	77.9684	78.7775	76.7386	72.3982	66.9192	61.7697	58.3296	57.5205	59.5593	63.8997	69.3787	74.5282 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036 (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)												
	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287 (71)
Water heating gains (Table 5)												
	115.1440	113.6773	110.8800	104.7876	101.0482	97.1436	94.7619	96.7542	99.0873	103.4205	109.2629	114.3677 (72)
Total internal gains												
	279.5452	284.0114	274.0514	265.2127	254.4002	246.9403	239.5243	240.7075	246.6735	253.7530	266.6685	275.3288 (73)

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6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W
North			1.6200	10.6334		0.7200		0.7000		0.7700		6.0166 (74)
Solar gains	6.0166	11.4980	19.5379	31.3829	42.2757	45.2574	42.2536	33.5228	23.4909	13.6869	7.4222	5.0157 (83)
Total gains	285.5618	295.5094	293.5894	296.5956	296.6759	292.1977	281.7778	274.2303	270.1645	267.4399	274.0908	280.3445 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l1} ,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.9584	65.2035	65.4456	66.6072	66.8291	67.8820	67.8820	68.0806	67.4725	66.8291	66.3817	65.9203
alpha	5.3306	5.3469	5.3630	5.4405	5.4553	5.5255	5.5255	5.5387	5.4982	5.4553	5.4254	5.3947
util living area	0.9939	0.9916	0.9869	0.9694	0.9168	0.7661	0.5858	0.6223	0.8412	0.9626	0.9881	0.9945 (86)
MIT	19.8788	19.9814	20.1631	20.4567	20.7341	20.9348	20.9878	20.9831	20.8840	20.5667	20.1981	19.8779 (87)
Th 2	19.3960	19.4009	19.4057	19.4284	19.4327	19.4526	19.4526	19.4563	19.4449	19.4327	19.4241	19.4151 (88)
util rest of house	0.9904	0.9866	0.9783	0.9471	0.8527	0.6184	0.3881	0.4253	0.7155	0.9306	0.9798	0.9913 (89)
MIT 2	18.1929	18.3264	18.5590	18.9364	19.2491	19.4302	19.4513	19.4541	19.3942	19.0734	18.6177	18.2057 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	19.4005	19.5119	19.7080	20.0254	20.3128	20.5079	20.5519	20.5493	20.4614	20.1430	19.7498	19.4035 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.4005	19.5119	19.7080	20.0254	20.3128	20.5079	20.5519	20.5493	20.4614	20.1430	19.7498	19.4035 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9904	0.9870	0.9803	0.9572	0.8931	0.7243	0.5312	0.5681	0.8043	0.9478	0.9819	0.9913 (94)
Useful gains	282.8237	291.6693	287.8078	283.8927	264.9536	211.6414	149.6682	155.7773	217.2808	253.4691	269.1404	277.9046 (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	607.0437	585.1931	527.0110	436.1721	336.5448	227.2716	152.0240	159.1538	246.1994	372.8926	497.6197	602.2647 (97)
Space heating kWh	241.2197	197.2480	177.9672	109.6412	53.2639	0.0000	0.0000	0.0000	0.0000	88.8511	164.5050	241.3240 (98a)
Space heating requirement - total per year (kWh/year)	1274.0201											
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	241.2197	197.2480	177.9672	109.6412	53.2639	0.0000	0.0000	0.0000	0.0000	88.8511	164.5050	241.3240 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1274.0201											
Space heating per m2	(98c) / (4) = 60.4374 (99)											

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (301)
Fraction of space heat from community system												0.0000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating:												
Space heating requirement	241.2197	197.2480	177.9672	109.6412	53.2639	0.0000	0.0000	0.0000	0.0000	88.8511	164.5050	241.3240 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	325.6466	266.2848	240.2558	148.0156	71.9062	0.0000	0.0000	0.0000	0.0000	119.9490	222.0818	325.7874
Space heating requirement	325.6466	266.2848	240.2558	148.0156	71.9062	0.0000	0.0000	0.0000	0.0000	119.9490	222.0818	325.7874 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	100.0000 (308)											
Space heating fuel for secondary/supplementary system	24.1220	19.7248	17.7967	10.9641	5.3264	0.0000	0.0000	0.0000	0.0000	8.8851	16.4505	24.1324 (309)
Water heating												
Annual water heating requirement	179.9255	159.5490	170.3843	151.6955	148.3848	135.1432	134.3186	138.7766	139.3521	153.6930	161.3865	178.1886 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	269.8882	239.3236	255.5765	227.5433	222.5771	202.7148	201.4779	208.1649	209.0281	230.5395	242.0797	267.2828
Water heating fuel	269.8882	239.3236	255.5765	227.5433	222.5771	202.7148	201.4779	208.1649	209.0281	230.5395	242.0797	267.2828 (310)
Cooling System Energy Efficiency Ratio	0.0000 (314)											
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
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 (331)
Lighting	9.9365	7.9714	7.1774	5.2585	4.0618	3.3185	3.7053	4.8163	6.2559	8.2080	9.2710	10.2126 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-14.5562	-20.3014	-28.5989	-31.3756	-33.0748	-30.0494	-29.7890	-28.2593	-25.5740	-22.6165	-15.8765	-12.6517 (333a)

12b. Carbon dioxide emissions - Community heating scheme

13b. Primary energy - Community heating scheme

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

Ground floor		Area (m2)	Storey height (m)	Volume (m3)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	21.0800	21.0800 (1b)	x 4.3200 (2b)	= 91.0656 (1b) - (4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 91.0656 (5)

2. Ventilation rate

													m3 per hour
Number of open chimneys													0 * 80 = 0.0000 (6a)
Number of open flues													0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire													0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler													0 * 20 = 0.0000 (6d)
Number of flues attached to other heater													0 * 35 = 0.0000 (6e)
Number of blocked chimneys													0 * 20 = 0.0000 (6f)
Number of intermittent extract fans													2 * 10 = 20.0000 (7a)
Number of passive vents													0 * 10 = 0.0000 (7b)
Number of flueless gas fires													0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =													20.0000 / (5) = 0.2196 (8)
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													5.0000 (17)
Infiltration rate													0.4696 (18)
Number of sides sheltered													2 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.3992 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(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													
	0.5090	0.4990	0.4890	0.4391	0.4291	0.3792	0.3792	0.3692	0.3992	0.4291	0.4491	0.4690	(22b)
Effective ac	0.6295	0.6245	0.6196	0.5964	0.5921	0.5719	0.5719	0.5682	0.5797	0.5921	0.6008	0.6100	(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)			1.6200	1.1450	1.8550			(27)
Heatloss Floor 1			21.0800	0.1300	2.7404			(28a)
External Wall 1	32.2600	1.6200	30.6400	0.1800	5.5152			(29a)
Total net area of external elements Aum(A, m2)			53.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.1106			(33)
Party Wall 1			32.2600	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								455.9587 (35)
Thermal bridges (User defined value 0.050 * total exposed area)								2.6670 (36)
Point Thermal bridges								0.0000 (36a)
Total fabric heat loss								(33) + (36) + (36a) = 12.7776 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	18.9180	18.7669	18.6187	17.9229	17.7927	17.1867	17.1867	17.0744	17.4201	17.7927	18.0561	18.3314	(38)
	31.6956	31.5444	31.3963	30.7005	30.5703	29.9642	29.9642	29.8520	30.1977	30.5703	30.8336	31.1090	(39)
Average = Sum(39)m / 12 =													30.6998
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.5036	1.4964	1.4894	1.4564	1.4502	1.4215	1.4215	1.4161	1.4325	1.4502	1.4627	1.4758	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0407 (42)
Hot water usage for mixer showers													
	53.4165	52.6138	51.4440	49.2059	47.5542	45.7123	44.6653	45.8262	47.0988	49.0765	51.3627	53.2119	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	25.2880	24.3684	23.4489	22.5293	21.6097	20.6902	20.6902	21.6097	22.5293	23.4489	24.3684	25.2880	(42c)
Average daily hot water use (litres/day)													72.2373 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	78.7045	76.9822	74.8929	71.7352	69.1639	66.4024	65.3555	67.4359	69.6281	72.5253	75.7311	78.4998	(44)

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Energy content (annual)	124.6487	109.6216	115.1075	98.2019	93.1079	81.6495	79.0418	83.4998	85.8584	98.4162	107.8928	122.9118 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1199.9579
Water storage loss:	18.6973	16.4432	17.2661	14.7303	13.9662	12.2474	11.8563	12.5250	12.8788	14.7624	16.1839	18.4368 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	171.2436	151.7073	161.7024	143.2937	139.7029	126.7414	125.6367	130.0947	130.9502	145.0111	152.9846	169.5067 (62)
WWHRS	-24.4198	-21.5971	-22.6152	-18.7263	-17.4522	-14.9340	-13.9982	-14.8857	-15.4513	-18.2154	-20.6358	-23.9676 (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	146.8238	130.1102	139.0872	124.5674	122.2506	111.8074	111.6385	115.2090	115.4989	126.7957	132.3489	145.5391 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1521.6767 (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	78.7216	70.1178	75.5492	68.7256	68.2343	63.2219	63.5573	65.0396	64.6214	69.9993	71.9478	78.1441 (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	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.8221	52.9459	47.8221	49.4162	47.8221	49.4162	47.8221	47.8221	49.4162	47.8221	49.4162	47.8221 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	77.9684	78.7775	76.7386	72.3982	66.9192	61.7697	58.3296	57.5205	59.5593	63.8997	69.3787	74.5282 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036 (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)	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287 (71)
Water heating gains (Table 5)	105.8086	104.3419	101.5446	95.4522	91.7128	87.8083	85.4265	87.4188	89.7519	94.0851	99.9275	105.0324 (72)
Total internal gains	273.2098	277.6760	267.7161	258.8773	248.0648	237.6049	230.1889	231.3721	237.3381	247.4176	260.3332	268.9934 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.6200	10.6334		0.6300		0.7000		0.7700		5.2645 (74)
Solar gains	5.2645	10.0608	17.0957	27.4601	36.9912	39.6002	36.9719	29.3325	20.5546	11.9760	6.4945	4.3888	(83)
Total gains	278.4743	287.7367	284.8117	286.3374	285.0561	277.2051	267.1607	260.7046	257.8927	259.3937	266.8276	273.3822	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	84.2355	84.6391	85.0385	86.9659	87.3362	89.1027	89.1027	89.4377	88.4139	87.3362	86.5902	85.8238
alpha	6.6157	6.6426	6.6692	6.7977	6.8224	6.9402	6.9402	6.9625	6.8943	6.8224	6.7727	6.7216
util living area	0.9932	0.9899	0.9831	0.9550	0.8710	0.6743	0.4916	0.5238	0.7641	0.9423	0.9844	0.9938 (86)
MIT	20.2509	20.3384	20.4798	20.7080	20.8926	20.9855	20.9985	20.9977	20.9663	20.7809	20.5060	20.2540 (87)
Th 2	20.2482	20.2518	20.2553	20.2718	20.2749	20.2893	20.2893	20.2919	20.2837	20.2749	20.2687	20.2621 (88)
util rest of house	0.9912	0.9870	0.9779	0.9406	0.8328	0.6067	0.4132	0.4448	0.7007	0.9217	0.9792	0.9921 (89)
MIT 2	19.5681	19.6577	19.8001	20.0341	20.2012	20.2824	20.2888	20.2912	20.2657	20.1060	19.8377	19.5830 (90)
Living area fraction									fLA = Living area / (4) =			0.7163 (91)
MIT	20.0572	20.1453	20.2870	20.5169	20.6965	20.7861	20.7972	20.7973	20.7675	20.5894	20.3165	20.0637 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0572	20.1453	20.2870	20.5169	20.6965	20.7861	20.7972	20.7973	20.7675	20.5894	20.3165	20.0637 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906	0.9865	0.9781	0.9459	0.8560	0.6545	0.4694	0.5014	0.7445	0.9314	0.9796	0.9915	(94)
Useful gains	275.8599	283.8481	278.5873	270.8536	244.0105	181.4395	125.4080	130.7178	192.0081	241.6024	261.3921	271.0568	(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	499.4329	480.9054	432.8602	356.6427	275.0246	185.3605	125.7656	131.2688	201.3438	305.3796	407.5114	493.5021	(97)
Space heating kWh	166.3383	132.4225	114.7791	61.7682	23.0745	0.0000	0.0000	0.0000	0.0000	47.4503	105.2059	165.4993	(98a)
Space heating requirement - total per year (kWh/year)												816.5380	
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	166.3383	132.4225	114.7791	61.7682	23.0745	0.0000	0.0000	0.0000	0.0000	47.4503	105.2059	165.4993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												816.5380	
Space heating per m2										(98c) / (4) =		38.7352	(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	166.3383	132.4225	114.7791	61.7682	23.0745	0.0000	0.0000	0.0000	0.0000	47.4503	105.2059	165.4993	(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)	180.2149	143.4697	124.3544	66.9211	24.9995	0.0000	0.0000	0.0000	0.0000	51.4088	113.9825	179.3059	(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	146.8238	130.1102	139.0872	124.5674	122.2506	111.8074	111.6385	115.2090	115.4989	126.7957	132.3489	145.5391	(64)
Efficiency of water heater													79.8000 (216)
(217)m	84.3403	84.0993	83.6323	82.5742	81.1052	79.8000	79.8000	79.8000	79.8000	82.0650	83.5502	84.3487	(217)
Fuel for water heating, kWh/month	174.0849	154.7102	166.3080	150.8551	150.7310	140.1095	139.8978	144.3721	144.7355	154.5065	158.4064	172.5445	(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	9.9365	7.9714	7.1774	5.2585	4.0618	3.3185	3.7053	4.8163	6.2559	8.2080	9.2710	10.2126	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.7323	-15.5999	-23.1318	-26.8991	-29.8426	-28.2414	-27.9825	-26.0547	-22.7093	-18.3251	-11.9967	-9.2313	(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	-4.7004	-10.0233	-20.1496	-30.5653	-40.6631	-40.8729	-40.3050	-33.9367	-24.6847	-14.3350	-6.2834	-3.7001	(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													884.6566 (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													1851.2615 (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)													80.1931 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-520.9659 (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													2381.1453 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	884.6566	0.2100	185.7779 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1851.2615	0.2100	388.7649 (264)
Space and water heating			574.5428 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	80.1931	0.1443	11.5743 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-250.7465	0.1338	-33.5624
PV Unit electricity exported	-270.2194	0.1257	-33.9550
Total			-67.5173 (269)
Total CO2, kg/year			530.5291 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			25.1700 (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	884.6566	1.1300	999.6619 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1851.2615	1.1300	2091.9255 (278)
Space and water heating			3091.5874 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	80.1931	1.5338	123.0029 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-250.7465	1.4946	-374.7768
PV Unit electricity exported	-270.2194	0.4612	-124.6363
Total			-499.4131 (283)
Total Primary energy kWh/year			2845.2781 (286)
Target Primary Energy Rate (TPER)			134.9800 (287)

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Property Reference	Studio Flat 3			Issued on Date	21/08/2023
Assessment Reference	Baseline	Prop Type Ref	Existing 03		
Property					
SAP Rating	71 C	DER	35.00	TER	18.94
Environmental	86 B	% DER < TER			-85.27
CO ₂ Emissions (t/year)	0.68	DFEE	60.00	TFEE	27.80
Compliance Check	See BREL	% DFEE < TFEE			-149.82
% DPER < TPER	-117.15	DPER	219.30	TPER	100.99
Assessor Details				Assessor ID	V022-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	21.0800 (1b)	x 2.8900 (2b)	= 60.9212 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	21.0800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 60.9212 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.3283 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	1.0783 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.9165 (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	1.1686	1.1457	1.1228	1.0082	0.9853	0.8707	0.8707	0.8478	0.9165	0.9853	1.0311	1.0769 (22b)
Effective ac	1.1686	1.1457	1.1228	1.0082	0.9854	0.8791	0.8791	0.8594	0.9200	0.9854	1.0311	1.0769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			4.2200	1.3258	5.5947		(27)
External Wall 1	16.8200	4.2200	12.6000	0.3000	3.7800	17.0000	214.2000 (29a)
Flat Ceiling	13.3900		13.3900	0.1600	2.1424	9.0000	120.5100 (30)
Total net area of external elements A _{um} (A, m ²)			30.2100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		11.5171		(33)
Party Wall 1			46.2200	0.0000	0.0000	180.0000	8319.6000 (32)
Party Floor 1			21.0800			30.0000	632.4000 (32d)
Party Ceiling 1			7.6800			20.0000	153.6000 (32b)

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Internal Wall 1	31.2100	9.0000	280.8900 (32c)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	9721.2000 (34)		
Thermal bridges (Default value 0.200 * total exposed area)	461.1575 (35)		
Point Thermal bridges	6.0420 (36)		
Total fabric heat loss	(36a) = 0.0000		
	(33) + (36) + (36a) = 17.5591 (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	23.4935	23.0329	22.5722	20.2689	19.8104	17.6730	17.6730	17.2772	18.4963	19.8104	20.7296	21.6509 (38)
Heat transfer coeff	41.0526	40.5920	40.1313	37.8280	37.3695	35.2321	35.2321	34.8363	36.0554	37.3695	38.2887	39.2100 (39)
Average = Sum(39)m / 12 =	37.7665											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.9475	1.9256	1.9038	1.7945	1.7727	1.6714	1.6714	1.6526	1.7104	1.7727	1.8164	1.8601 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.0407 (42)											
Hot water usage for mixer showers	53.4165	52.6138	51.4440	49.2059	47.5542	45.7123	44.6653	45.8262	47.0988	49.0765	51.3627	53.2119 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.2880	24.3684	23.4489	22.5293	21.6097	20.6902	20.6902	21.6097	22.5293	23.4489	24.3684	25.2880 (42c)
Average daily hot water use (litres/day)	72.2373 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.7045	76.9822	74.8929	71.7352	69.1639	66.4024	65.3555	67.4359	69.6281	72.5253	75.7311	78.4998 (44)
Energy content (annual)	124.6487	109.6216	115.1075	98.2019	93.1079	81.6495	79.0418	83.4998	85.8584	98.4162	107.8928	122.9118 (45)
Distribution loss (46)m = 0.15 x (45)m	1199.9579											
Water storage loss:	18.6973	16.4432	17.2661	14.7303	13.9662	12.2474	11.8563	12.5250	12.8788	14.7624	16.1839	18.4368 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	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	175.6076	155.6490	166.0664	147.5169	144.0669	130.9646	130.0007	134.4587	135.1735	149.3751	157.2079	173.8707 (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	175.6076	155.6490	166.0664	147.5169	144.0669	130.9646	130.0007	134.4587	135.1735	149.3751	157.2079	173.8707 (64)
12Total per year (kWh/year)	1799.9579 (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	54.1854	47.9560	51.0130	44.9809	43.6981	39.4772	39.0211	40.5034	40.8767	45.4631	48.2031	53.6079 (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	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5992	43.8420	39.5992	40.9192	39.5992	40.9192	39.5992	39.5992	40.9192	39.5992	40.9192	39.5992 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	77.9684	78.7775	76.7386	72.3982	66.9192	61.7697	58.3296	57.5205	59.5593	63.8997	69.3787	74.5282 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287 (71)
Water heating gains (Table 5)	72.8299	71.3631	68.5658	62.4735	58.7340	54.8295	52.4477	54.4401	56.7732	61.1063	66.9488	72.0536 (72)
Total internal gains	232.0082	235.5933	226.5144	217.4016	206.8632	196.1292	188.9873	190.1705	195.8624	206.2160	218.8574	227.7918 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	Specific data	FF Specific data	Access factor	Gains W
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				W/m2		or Table 6b		or Table 6c		Table 6d			
East		4.2200		19.6403		0.7200		0.7000		0.7700		28.9483 (76)	
Solar gains	28.9483	56.6291	93.2600	136.0142	166.6905	170.6374	162.4537	139.5454	108.4653	67.1952	36.0952	23.8057	(83)
Total gains	260.9565	292.2224	319.7744	353.4158	373.5537	366.7665	351.4410	329.7159	304.3277	273.4112	254.9526	251.5975	(84)

7. Mean internal temperature (heating season)													

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.7774	66.5238	67.2874	71.3845	72.2603	76.6442	76.6442	77.5150	74.8940	72.2603	70.5256	68.8685	
alpha	5.3852	5.4349	5.4858	5.7590	5.8174	6.1096	6.1096	6.1677	5.9929	5.8174	5.7017	5.5912	
util living area	0.9966	0.9930	0.9828	0.9378	0.8208	0.6023	0.4394	0.4831	0.7585	0.9578	0.9921	0.9972	(86)
MIT	19.8065	19.9786	20.2460	20.6402	20.8832	20.9868	20.9983	20.9972	20.9484	20.6381	20.2062	19.8459	(87)
Th 2	19.3686	19.3834	19.3983	19.4739	19.4891	19.5614	19.5614	19.5750	19.5334	19.4891	19.4586	19.4283	(88)
util rest of house	0.9944	0.9886	0.9715	0.8993	0.7299	0.4739	0.2968	0.3352	0.6266	0.9224	0.9862	0.9954	(89)
MIT 2	18.3613	18.5428	18.8152	19.2398	19.4366	19.5586	19.5613	19.5748	19.5184	19.2608	18.8283	18.4473	(90)
Living area fraction									fLA = Living area / (4) =			0.6931	(91)
MIT	19.3629	19.5379	19.8068	20.2104	20.4392	20.5484	20.5573	20.5606	20.5095	20.2154	19.7833	19.4166	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3629	19.5379	19.8068	20.2104	20.4392	20.5484	20.5573	20.5606	20.5095	20.2154	19.7833	19.4166	(93)

8. Space heating requirement													

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9891	0.9750	0.9202	0.7904	0.5632	0.3959	0.4380	0.7183	0.9423	0.9878	0.9954	(94)
Useful gains	259.5026	289.0513	311.7886	325.2148	295.2568	206.5781	139.1257	144.4283	218.5886	257.6236	251.8380	250.4291	(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	618.3721	594.1813	534.0208	427.8500	326.5788	209.5747	139.4224	144.9403	231.0966	359.3218	485.6258	596.6432	(97)
Space heating kWh	266.9989	205.0473	165.3407	73.8973	23.3036	0.0000	0.0000	0.0000	0.0000	75.6635	168.3272	257.5833	(98a)
Space heating requirement - total per year (kWh/year)												1236.1618	
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	266.9989	205.0473	165.3407	73.8973	23.3036	0.0000	0.0000	0.0000	0.0000	75.6635	168.3272	257.5833	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1236.1618	
Space heating per m2										(98c) / (4) =		58.6415	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													79.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	266.9989	205.0473	165.3407	73.8973	23.3036	0.0000	0.0000	0.0000	0.0000	75.6635	168.3272	257.5833	(98)
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000	(210)
Space heating fuel (main heating system)	304.1759	233.5982	188.3629	84.1868	26.5484	0.0000	0.0000	0.0000	0.0000	86.1989	191.7652	293.4493	(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)	26.6999	20.5047	16.5341	7.3897	2.3304	0.0000	0.0000	0.0000	0.0000	7.5663	16.8327	25.7583	(215)
Water heating													
Water heating requirement	175.6076	155.6490	166.0664	147.5169	144.0669	130.9646	130.0007	134.4587	135.1735	149.3751	157.2079	173.8707	(64)
Efficiency of water heater (217)m	79.9492	79.6281	79.0002	77.5831	76.0353	75.0000	75.0000	75.0000	75.0000	77.6036	79.1624	75.0000	(216)
Fuel for water heating, kWh/month	155.9099	137.6670	145.7054	126.5764	122.4536	108.8661	105.3890	111.3330	114.4778	126.8191	136.2931	153.8488	(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	55.4858	50.1162	55.4858	53.6959	55.4858	53.6959	55.4858	55.4858	53.6959	55.4858	53.6959	55.4858	(231)
Lighting	8.2279	6.6008	5.9432	4.3543	3.3634	2.7479	3.0682	3.9881	5.1802	6.7967	7.6768	8.4566	(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)													

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(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(235d)m	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												1408.2856	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												123.6162	(215)
Efficiency of water heater												75.0000	
Water heating fuel used												1545.3393	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												53.3000	(230c)
maintaining electric keep-hot facility for gas combi boiler												600.0000	(230f)
Total electricity for the above, kWh/year												653.3000	(231)
Electricity for lighting (calculated in Appendix L)												66.4041	(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												3796.9452	(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	1408.2856	0.2100	295.7400	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	123.6162	0.1561	19.2963	(263)
Water heating (other fuel)	1545.3393	0.2100	324.5213	(264)
Space and water heating			639.5575	(265)
Pumps, fans and electric keep-hot	653.3000	0.1387	90.6208	(267)
Energy for lighting	66.4041	0.1443	9.5842	(268)
Total CO2, kg/year			739.7624	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			35.0900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1408.2856	1.1300	1591.3627	(275)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	123.6162	1.5779	195.0557	(277)
Water heating (other fuel)	1545.3393	1.1300	1746.2334	(278)
Space and water heating			3532.6519	(279)
Pumps, fans and electric keep-hot	653.3000	1.5128	988.3122	(281)
Energy for lighting	66.4041	1.5338	101.8529	(282)
Total Primary energy kWh/year			4622.8170	(286)
Dwelling Primary energy Rate (DPER)			219.3000	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	21.0800	(1b)	x	2.8900 (2b) = 60.9212 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	21.0800			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	60.9212 (5)

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2. Ventilation rate

			m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)	
Number of open flues	0 * 20 =	0.0000	(6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)	
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)	
Number of blocked chimneys	0 * 20 =	0.0000	(6f)	
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)	
Number of passive vents	0 * 10 =	0.0000	(7b)	
Number of flueless gas fires	0 * 40 =	0.0000	(7c)	
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.3283	(8)	
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.5783	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4915	(21)	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (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	0.6267	0.6144	0.6021	0.5407	0.5284	0.4670	0.4670	0.4547	0.4915	0.5284	0.5530	0.5776 (22b)
Effective ac	0.6964	0.6888	0.6813	0.6462	0.6396	0.6090	0.6090	0.6034	0.6208	0.6396	0.6529	0.6668 (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)			4.2200	1.1450	4.8321			(27)				
External Wall 1	16.8200	4.2200	12.6000	0.1800	2.2680			(29a)				
Flat Ceiling	13.3900		13.3900	0.1100	1.4729			(30)				
Total net area of external elements Aum(A, m2)			30.2100					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			8.5730		(33)				
Party Wall 1			46.2200	0.0000	0.0000			(32)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								464.8008 (35)				
Thermal bridges (User defined value 0.050 * total exposed area)								1.5105 (36)				
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	10.0835 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 14.0003	Feb 13.8469	Mar 13.6967	Apr 12.9908	May 12.8587	Jun 12.2440	Jul 12.2440	Aug 12.1301	Sep 12.4808	Oct 12.8587	Nov 13.1259	Dec 13.4052 (38)
Heat transfer coeff	24.0837	23.9304	23.7801	23.0743	22.9422	22.3274	22.3274	22.2136	22.5642	22.9422	23.2094	23.4887 (39)
Average = Sum(39)m / 12 =												23.0736
HLP	Jan 1.1425	Feb 1.1352	Mar 1.1281	Apr 1.0946	May 1.0883	Jun 1.0592	Jul 1.0592	Aug 1.0538	Sep 1.0704	Oct 1.0883	Nov 1.1010	Dec 1.1143 (40)
HLP (average)												1.0946
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.0407 (42)											
Hot water usage for mixer showers	53.4165	52.6138	51.4440	49.2059	47.5542	45.7123	44.6653	45.8262	47.0988	49.0765	51.3627	53.2119 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.2880	24.3684	23.4489	22.5293	21.6097	20.6902	20.6902	21.6097	22.5293	23.4489	24.3684	25.2880 (42c)
Average daily hot water use (litres/day)												72.2373 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.7045	76.9822	74.8929	71.7352	69.1639	66.4024	65.3555	67.4359	69.6281	72.5253	75.7311	78.4998 (44)
Energy content (annual)	124.6487	109.6216	115.1075	98.2019	93.1079	81.6495	79.0418	83.4998	85.8584	98.4162	107.8928	122.9118 (45)
Distribution loss (46)m = 0.15 x (45)m	18.6973	16.4432	17.2661	14.7303	13.9662	12.2474	11.8563	12.5250	12.8788	14.7624	16.1839	18.4368 (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	40.1069	35.4329	38.1646	35.3763	35.2452	32.7464	33.3044	34.3646	34.3371	36.9581	37.3468	40.0027 (61)

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Total heat required for water heating calculated for each month

	164.7556	145.0545	153.2721	133.5781	128.3531	114.3959	112.3462	117.8644	120.1955	135.3743	145.2396	162.9144 (62)
WWHRS	-24.4198	-21.5971	-22.6152	-18.7263	-17.4522	-14.9340	-13.9982	-14.8857	-15.4513	-18.2154	-20.6358	-23.9676 (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	140.3358	123.4574	130.6569	114.8518	110.9009	99.4620	98.3480	102.9787	104.7442	117.1589	124.6038	138.9468 (64)
	Total per year (kWh/year) = Sum(64)m =											1406.4453 (64)
12Total per year (kWh/year)												1406 (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	51.4724	45.3074	47.8144	41.4962	39.7697	35.3351	34.6075	36.3548	37.1322	41.9629	45.2111	50.8688 (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	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5992	43.8420	39.5992	40.9192	39.5992	40.9192	39.5992	39.5992	40.9192	39.5992	40.9192	39.5992 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	77.9684	78.7775	76.7386	72.3982	66.9192	61.7697	58.3296	57.5205	59.5593	63.8997	69.3787	74.5282 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036 (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)	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287 (71)
Water heating gains (Table 5)	69.1834	67.4217	64.2667	57.6336	53.4539	49.0765	46.5155	48.8640	51.5725	56.4018	62.7931	68.3721 (72)
Total internal gains	228.3617	231.6519	222.2153	212.5617	201.5831	190.3762	183.0550	184.5945	190.6617	201.5114	214.7018	224.1102 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				4.2200	19.6403		0.6300		0.7000		0.7700		25.3298 (76)
Solar gains	25.3298	49.5504	81.6025	119.0124	145.8542	149.3077	142.1470	122.1022	94.9071	58.7958	31.5833	20.8300	(83)
Total gains	253.6915	281.2024	303.8178	331.5741	347.4372	339.6839	325.2020	306.6967	285.5689	260.3072	246.2851	244.9402	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	113.0085	113.7326	114.4513	117.9525	118.6314	121.8979	121.8979	122.5227	120.6187	118.6314	117.2659	115.8714
alpha	8.5339	8.5822	8.6301	8.8635	8.9088	9.1265	9.1265	9.1682	9.0412	8.9088	8.8177	8.7248
util living area	0.9927	0.9810	0.9434	0.8066	0.6110	0.4206	0.3021	0.3332	0.5442	0.8557	0.9764	0.9940 (86)
MIT	20.5443	20.6681	20.8234	20.9642	20.9967	20.9999	21.0000	21.0000	20.9991	20.9517	20.7500	20.5405 (87)
Th 2	19.9663	19.9722	19.9780	20.0052	20.0104	20.0343	20.0343	20.0388	20.0251	20.0104	20.0000	19.9892 (88)
util rest of house	0.9887	0.9713	0.9185	0.7534	0.5476	0.3572	0.2358	0.2635	0.4679	0.7977	0.9628	0.9907 (89)
MIT 2	19.4744	19.6315	19.8164	19.9801	20.0088	20.0343	20.0343	20.0388	20.0248	19.9781	19.7567	19.4891 (90)
Living area fraction	20.2159	20.3499	20.5143	20.6621	20.6935	20.7035	20.7036	20.7050	20.7001	20.6529	20.4451	20.2178 (91)
Temperature adjustment	20.2159	20.3499	20.5143	20.6621	20.6935	20.7035	20.7036	20.7050	20.7001	20.6529	20.4451	20.2178 (92)
adjusted MIT	20.2159	20.3499	20.5143	20.6621	20.6935	20.7035	20.7036	20.7050	20.7001	20.6529	20.4451	20.2178 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9898	0.9753	0.9326	0.7893	0.5915	0.4011	0.2817	0.3118	0.5208	0.8368	0.9697	0.9916 (94)
Ext temp.	251.1074	274.2700	283.3285	261.7092	205.5184	136.2566	91.6222	95.6271	148.7269	217.8315	238.8132	242.8878 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	383.3140	369.7226	333.2620	271.4022	206.3304	136.2761	91.6229	95.6286	148.9252	230.6349	309.7319	376.2376 (97)
Space heating requirement - total per year (kWh/year)	98.3618	64.1442	37.1505	6.9789	0.6041	0.0000	0.0000	0.0000	0.0000	9.5257	51.0614	99.2123 (98a)
Solar heating kWh												367.0389
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)

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Space heating kWh	98.3618	64.1442	37.1505	6.9789	0.6041	0.0000	0.0000	0.0000	0.0000	9.5257	51.0614	99.2123 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												367.0389
Space heating per m ²										(98c) / (4) =		17.4117 (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	98.3618	64.1442	37.1505	6.9789	0.6041	0.0000	0.0000	0.0000	0.0000	9.5257	51.0614	99.2123 (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)	106.4521	69.4201	40.2062	7.5530	0.6538	0.0000	0.0000	0.0000	0.0000	10.3092	55.2613	107.3726 (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	140.3358	123.4574	130.6569	114.8518	110.9009	99.4620	98.3480	102.9787	104.7442	117.1589	124.6038	138.9468 (64)
Efficiency of water heater	83.6339	83.0469	82.0574	80.7475	80.3421	80.3000	80.3000	80.3000	80.3000	80.8884	82.6233	80.3000 (216)
Fuel for water heating, kWh/month	167.7977	148.6599	159.2263	142.2358	138.0358	123.8630	122.4757	128.2424	130.4411	144.8402	150.8096	83.6719 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	8.2279	6.6008	5.9432	4.3543	3.3634	2.7479	3.0682	3.9881	5.1802	6.7967	7.6768	8.4566 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.7032	-15.5485	-23.0510	-26.8078	-29.7505	-28.1596	-27.8919	-25.9522	-22.6078	-18.2485	-11.9570	-9.2066 (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	-4.7295	-10.0747	-20.2304	-30.6566	-40.7552	-40.9546	-40.3956	-34.0391	-24.7862	-14.4115	-6.3231	-3.7247 (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												397.2282 (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												1722.6891 (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)												66.4041 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-520.9659 (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												1751.3555 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	397.2282	0.2100	83.4179 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	1722.6891	0.2100	361.7647 (264)
Space and water heating			445.1826 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	66.4041	0.1443	9.5842 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-249.8847	0.1339	-33.4477

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PV Unit electricity exported	-271.0812	0.1257	-34.0702
Total			-67.5179 (269)
Total CO2, kg/year			399.1781 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.9400 (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	397.2282	1.1300	448.8679 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1722.6891	1.1300	1946.6387 (278)
Space and water heating			2395.5065 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	66.4041	1.5338	101.8529 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-249.8847	1.4947	-373.4911
PV Unit electricity exported	-271.0812	0.4613	-125.0597
Total			-498.5508 (283)
Total Primary energy kWh/year			2128.9094 (286)
Target Primary Energy Rate (TPER)			100.9900 (287)

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Property Reference	Studio Flat 3				Issued on Date	21/08/2023	
Assessment Reference	Proposed			Prop Type Ref	Existing 03		
Property							
SAP Rating	77 C		DER	5.93		TER	19.43
Environmental	98 A		% DER < TER				99.48
CO ₂ Emissions (t/year)	0.11		DFEE	40.81		TFEE	27.89
Compliance Check	See BREL		% DFEE < TFEE				-46.32
% DPER < TPER	40.18		DPER	62.01		TPER	103.67
Assessor Details					Assessor ID	V922-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	21.0800 (1b)	x 2.8900 (2b)	= 60.9212 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	21.0800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 60.9212 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.3283 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	5.0000 (17)
Number of sides sheltered	0.5783 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4915 (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	0.6267	0.6144	0.6021	0.5407	0.5284	0.4670	0.4670	0.4547	0.4915	0.5284	0.5530	0.5776 (22b)
Effective ac	0.6964	0.6888	0.6813	0.6462	0.6396	0.6090	0.6090	0.6034	0.6208	0.6396	0.6529	0.6668 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			4.2200	1.3258	5.5947		(27)
External Wall 1	16.8200	4.2200	12.6000	0.1800	2.2680	17.0000	214.2000 (29a)
Flat Ceiling	13.3900		13.3900	0.1100	1.4729	9.0000	120.5100 (30)
Total net area of external elements A _{um} (A, m ²)			30.2100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		9.3356		(33)
Party Wall 1			46.2200	0.0000	0.0000	180.0000	8319.6000 (32)
Party Floor 1			21.0800			30.0000	632.4000 (32d)
Party Ceiling 1			7.6800			20.0000	153.6000 (32b)

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Internal Wall 1	31.2100	9.0000	280.8900 (32c)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	9721.2000 (34)		
Thermal bridges (Default value 0.200 * total exposed area)	461.1575 (35)		
Point Thermal bridges	6.0420 (36)		
Total fabric heat loss	(36a) = 0.0000		
	(33) + (36) + (36a) = 15.3776 (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	14.0003	13.8469	13.6967	12.9908	12.8587	12.2440	12.2440	12.1301	12.4808	12.8587	13.1259	13.4052 (38)
Heat transfer coeff	29.3779	29.2245	29.0743	28.3684	28.2363	27.6216	27.6216	27.5077	27.8584	28.2363	28.5035	28.7828 (39)
Average = Sum(39)m / 12 =	28.3678											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3936	1.3864	1.3792	1.3457	1.3395	1.3103	1.3103	1.3049	1.3216	1.3395	1.3522	1.3654 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.0407 (42)											
Hot water usage for mixer showers	53.4165	52.6138	51.4440	49.2059	47.5542	45.7123	44.6653	45.8262	47.0988	49.0765	51.3627	53.2119 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.2880	24.3684	23.4489	22.5293	21.6097	20.6902	20.6902	21.6097	22.5293	23.4489	24.3684	25.2880 (42c)
Average daily hot water use (litres/day)	72.2373 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.7045	76.9822	74.8929	71.7352	69.1639	66.4024	65.3555	67.4359	69.6281	72.5253	75.7311	78.4998 (44)
Energy content (annual)	124.6487	109.6216	115.1075	98.2019	93.1079	81.6495	79.0418	83.4998	85.8584	98.4162	107.8928	122.9118 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1199.9579											
Water storage loss:	18.6973	16.4432	17.2661	14.7303	13.9662	12.2474	11.8563	12.5250	12.8788	14.7624	16.1839	18.4368 (46)
Store volume	110.0000 (47)											
b) If manufacturer declared loss factor is not known :	0.0152 (51)											
Hot water storage loss factor from Table 2 (kWh/litre/day)	1.0294 (52)											
Volume factor from Table 2a	0.6000 (53)											
Temperature factor from Table 2b	1.0327 (55)											
Enter (49) or (54) in (55)												
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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	179.9255	159.5490	170.3843	151.6955	148.3848	135.1432	134.3186	138.7766	139.3521	153.6930	161.3865	178.1886 (62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	179.9255	159.5490	170.3843	151.6955	148.3848	135.1432	134.3186	138.7766	139.3521	153.6930	161.3865	178.1886 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 1850.7976 (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	85.6671	76.3911	82.4947	75.4471	75.1798	69.9434	70.5028	71.9851	71.3429	76.9448	78.6693	85.0896 (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	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.5992	43.8420	39.5992	40.9192	39.5992	40.9192	39.5992	39.5992	40.9192	39.5992	40.9192	39.5992 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	77.9684	78.7775	76.7386	72.3982	66.9192	61.7697	58.3296	57.5205	59.5593	63.8997	69.3787	74.5282 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036 (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)	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287 (71)
Water heating gains (Table 5)	115.1440	113.6773	110.8800	104.7876	101.0482	97.1436	94.7619	96.7542	99.0873	103.4205	109.2629	114.3677 (72)
Total internal gains	271.3223	274.9075	265.8286	256.7157	246.1773	238.4433	231.3014	232.4846	238.1765	245.5301	258.1716	267.1059 (73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East				4.2200	19.6403	0.7200		0.7000		0.7700	28.9483 (76)
Solar gains	28.9483	56.6291	93.2600	136.0142	166.6905	170.6374	162.4537	139.5454	108.4653	67.1952	23.8057 (83)
Total gains	300.2707	331.5365	359.0886	392.7299	412.8678	409.0807	393.7551	372.0300	346.6418	312.7253	290.9116 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	91.9173	92.3995	92.8771	95.1881	95.6333	97.7618	97.7618	98.1664	96.9308	95.6333	94.7369	93.8176
alpha	7.1278	7.1600	7.1918	7.3459	7.3756	7.5175	7.5175	7.5444	7.4621	7.3756	7.3158	7.2545
util living area	0.9881	0.9744	0.9361	0.8134	0.6276	0.4317	0.3086	0.3401	0.5515	0.8511	0.9681	0.9899 (86)
MIT	20.4240	20.5617	20.7458	20.9289	20.9896	20.9995	21.0000	20.9999	20.9968	20.9179	20.6679	20.4173 (87)
Th 2	19.7682	19.7738	19.7793	19.8052	19.8100	19.8328	19.8328	19.8370	19.8240	19.8100	19.8002	19.7900 (88)
util rest of house	0.9817	0.9617	0.9073	0.7542	0.5514	0.3532	0.2268	0.2541	0.4593	0.7859	0.9500	0.9844 (89)
MIT 2	19.1597	19.3319	19.5492	19.7547	19.8049	19.8326	19.8328	19.8370	19.8230	19.7553	19.4845	19.1693 (90)
Living area fraction									fLA = Living area / (4) =			0.6931 (91)
MIT	20.0360	20.1843	20.3785	20.5685	20.6260	20.6413	20.6417	20.6430	20.6365	20.5610	20.3047	20.0343 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0360	20.1843	20.3785	20.5685	20.6260	20.6413	20.6417	20.6430	20.6365	20.5610	20.3047	20.0343 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9833	0.9666	0.9227	0.7932	0.6041	0.4076	0.2835	0.3137	0.5233	0.8291	0.9586	0.9857 (94)
Useful gains	295.2631	320.4512	331.3209	311.5186	249.4190	166.7538	111.6324	116.7021	181.3857	259.2695	282.0869	286.7573 (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	462.2889	446.6753	403.5081	331.0161	252.0379	166.8706	111.6385	116.7148	182.0975	281.2635	376.3801	455.7549 (97)
Space heating kWh	124.2672	84.8226	53.7073	14.0382	1.9485	0.0000	0.0000	0.0000	0.0000	16.3635	67.8911	125.7342 (98a)
Space heating requirement - total per year (kWh/year)												488.7725
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	124.2672	84.8226	53.7073	14.0382	1.9485	0.0000	0.0000	0.0000	0.0000	16.3635	67.8911	125.7342 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												488.7725
Space heating per m2										(98c) / (4) =		23.1866 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (301)
Fraction of space heat from community system												0.9000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating:												
Space heating requirement	124.2672	84.8226	53.7073	14.0382	1.9485	0.0000	0.0000	0.0000	0.0000	16.3635	67.8911	125.7342 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	167.7607	114.5105	72.5048	18.9515	2.6304	0.0000	0.0000	0.0000	0.0000	22.0907	91.6530	169.7412
Space heating requirement	167.7607	114.5105	72.5048	18.9515	2.6304	0.0000	0.0000	0.0000	0.0000	22.0907	91.6530	169.7412 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												100.0000 (308)
Space heating fuel for secondary/supplementary system	12.4267	8.4823	5.3707	1.4038	0.1948	0.0000	0.0000	0.0000	0.0000	1.6363	6.7891	12.5734 (309)
Water heating												
Annual water heating requirement	179.9255	159.5490	170.3843	151.6955	148.3848	135.1432	134.3186	138.7766	139.3521	153.6930	161.3865	178.1886 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	269.8882	239.3236	255.5765	227.5433	222.5771	202.7148	201.4779	208.1649	209.0281	230.5395	242.0797	267.2828
Water heating fuel	269.8882	239.3236	255.5765	227.5433	222.5771	202.7148	201.4779	208.1649	209.0281	230.5395	242.0797	267.2828 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
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 (331)
Lighting	8.2279	6.6008	5.9432	4.3543	3.3634	2.7479	3.0682	3.9881	5.1802	6.7967	7.6768	8.4566 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(333a)m	-14.2357	-19.6573	-27.4167	-29.9949	-32.0709	-29.9405	-29.6672	-28.1178	-25.4266	-21.9275	-15.4670	-12.3868	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												659.8429	(307)
Space heating fuel - secondary												48.8773	(309)
Water heating fuel - community heating												2776.1965	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												6.5984	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(331)
Electricity for lighting (calculated in Appendix L)												66.4041	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-286.3088	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3265.0119	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	981.7255	0.1581	29.8083 (367)
Electrical energy for heat distribution (space & water)	6.5984	0.0000	4.9461 (372)
Overall CO2 factor for heat network			0.0426 (386)
Total CO2 associated with community systems			146.2647 (373)
Space heating - secondary	48.8773	0.1581	7.7281 (374)
Space and water heating			153.9927 (376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (378)
Energy for lighting	66.4041	0.1443	9.5842 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.3088	0.1350	-38.6568
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-38.6568 (380)
Total CO2, kg/year			124.9201 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.9300 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	981.7255	1.5853	298.8707 (467)
Electrical energy for heat distribution (space & water)	6.5984	0.0000	52.6534 (472)
Overall CO2 factor for heat network			0.4531 (486)
Total CO2 associated with community systems			1557.0351 (473)
Space heating - secondary	48.8773	1.5853	77.4850 (374)
Space and water heating			1634.5201 (476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (478)
Energy for lighting	66.4041	1.5338	101.8529 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-286.3088	1.4990	-429.1841
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-429.1841 (480)
Total Primary energy kWh/year			1307.1888 (483)
Dwelling Primary energy Rate (DPER)			62.0100 (484)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	21.0800 (1b)	x 2.8900 (2b)	= 60.9212 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	21.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	60.9212 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.3283 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.5783 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4915 (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	0.6267	0.6144	0.6021	0.5407	0.5284	0.4670	0.4670	0.4547	0.4915	0.5284	0.5530	0.5776 (22b)
Effective ac	0.6964	0.6888	0.6813	0.6462	0.6396	0.6090	0.6090	0.6034	0.6208	0.6396	0.6529	0.6668 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			4.2200	1.1450	4.8321		(27)
External Wall 1	16.8200	4.2200	12.6000	0.1800	2.2680		(29a)
Flat Ceiling	13.3900		13.3900	0.1100	1.4729		(30)
Total net area of external elements Aum(A, m ²)			30.2100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.5730		(33)
Party Wall 1			46.2200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	464.8008 (35)
Thermal bridges (User defined value 0.050 * total exposed area)	1.5105 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 10.0835 (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	14.0003	13.8469	13.6967	12.9908	12.8587	12.2440	12.2440	12.1301	12.4808	12.8587	13.1259	13.4052 (38)
Heat transfer coeff	24.0837	23.9304	23.7801	23.0743	22.9422	22.3274	22.3274	22.2136	22.5642	22.9422	23.2094	23.4887 (39)
Average = Sum(39)m / 12 =												23.0736

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1425	1.1352	1.1281	1.0946	1.0883	1.0592	1.0592	1.0538	1.0704	1.0883	1.1010	1.1143 (40)
HLP (average)												1.0946
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0407 (42)
Hot water usage for mixer showers	53.4165	52.6138	51.4440	49.2059	47.5542	45.7123	44.6653	45.8262	47.0988	49.0765	51.3627	53.2119 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.2880	24.3684	23.4489	22.5293	21.6097	20.6902	20.6902	21.6097	22.5293	23.4489	24.3684	25.2880 (42c)
Average daily hot water use (litres/day)												72.2373 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	78.7045	76.9822	74.8929	71.7352	69.1639	66.4024	65.3555	67.4359	69.6281	72.5253	75.7311	78.4998 (44)
Energy content (annual)	124.6487	109.6216	115.1075	98.2019	93.1079	81.6495	79.0418	83.4998	85.8584	98.4162	107.8928	122.9118 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1199.9579
	18.6973	16.4432	17.2661	14.7303	13.9662	12.2474	11.8563	12.5250	12.8788	14.7624	16.1839	18.4368 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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												
	171.2436	151.7073	161.7024	143.2937	139.7029	126.7414	125.6367	130.0947	130.9502	145.0111	152.9846	169.5067 (62)
WWHRS	-24.4198	-21.5971	-22.6152	-18.7263	-17.4522	-14.9340	-13.9982	-14.8857	-15.4513	-18.2154	-20.6358	-23.9676 (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												
	146.8238	130.1102	139.0872	124.5674	122.2506	111.8074	111.6385	115.2090	115.4989	126.7957	132.3489	145.5391 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1521.6767 (64)
Electric shower(s)												1522 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month												
	78.7216	70.1178	75.5492	68.7256	68.2343	63.2219	63.5573	65.0396	64.6214	69.9993	71.9478	78.1441 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358	52.0358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	39.5992	43.8420	39.5992	40.9192	39.5992	40.9192	39.5992	39.5992	40.9192	39.5992	40.9192	39.5992 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	77.9684	78.7775	76.7386	72.3982	66.9192	61.7697	58.3296	57.5205	59.5593	63.8997	69.3787	74.5282 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036	28.2036 (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)												
	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287	-41.6287 (71)
Water heating gains (Table 5)												
	105.8086	104.3419	101.5446	95.4522	91.7128	87.8083	85.4265	87.4188	89.7519	94.0851	99.9275	105.0324 (72)
Total internal gains												
	264.9870	268.5721	259.4932	250.3804	239.8420	229.1079	221.9660	223.1493	228.8412	239.1948	251.8362	260.7705 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East			4.2200		19.6403		0.6300		0.7000		0.7700		25.3298 (76)	
Solar gains	25.3298	49.5504	81.6025	119.0124	145.8542	149.3077	142.1470	122.1022	94.9071	58.7958	31.5833	20.8300 (83)		
Total gains	290.3167	318.1225	341.0957	369.3928	385.6961	378.4156	364.1130	345.2515	323.7483	297.9905	283.4195	281.6005 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	113.0085	113.7326	114.4513	117.9525	118.6314	121.8979	121.8979	122.5227	120.6187	118.6314	117.2659	115.8714
alpha	8.5339	8.5822	8.6301	8.8635	8.9088	9.1265	9.1265	9.1682	9.0412	8.9088	8.8177	8.7248
util living area												
	0.9820	0.9599	0.9009	0.7394	0.5519	0.3776	0.2698	0.2960	0.4806	0.7759	0.9461	0.9843 (86)
MIT	20.6450	20.7576	20.8862	20.9815	20.9985	21.0000	21.0000	21.0000	20.9997	20.9775	20.8342	20.6430 (87)
Th 2	19.9663	19.9722	19.9780	20.0052	20.0104	20.0343	20.0343	20.0388	20.0251	20.0104	20.0000	19.9892 (88)
util rest of house												
	0.9732	0.9426	0.8661	0.6852	0.4939	0.3206	0.2106	0.2341	0.4129	0.7127	0.9210	0.9766 (89)
MIT 2	19.5977	19.7354	19.8803	19.9929	20.0097	20.0343	20.0343	20.0388	20.0250	19.9966	19.8501	19.6153 (90)
Living area fraction												
	20.3236	20.4439	20.5774	20.6780	20.6950	20.7036	20.7036	20.7050	20.7005	20.6764	20.5321	20.3276 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3236	20.4439	20.5774	20.6780	20.6950	20.7036	20.7036	20.7050	20.7005	20.6764	20.5321	20.3276 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9766	0.9513	0.8876	0.7223	0.5341	0.3601	0.2516	0.2770	0.4598	0.7561	0.9354	0.9796	(94)
Useful gains	283.5292	302.6257	302.7443	266.7988	205.9994	136.2693	91.6227	95.6282	148.8635	225.3019	265.1204	275.8431	(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	385.9076	371.9717	334.7633	271.7698	206.3652	136.2771	91.6229	95.6287	148.9354	231.1758	311.7515	378.8156	(97)
Space heating kWh	76.1695	46.6005	23.8221	3.5791	0.2721	0.0000	0.0000	0.0000	0.0000	4.3702	33.5744	76.6115	(98a)
Space heating requirement - total per year (kWh/year)												264.9995	
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	76.1695	46.6005	23.8221	3.5791	0.2721	0.0000	0.0000	0.0000	0.0000	4.3702	33.5744	76.6115	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												264.9995	
Space heating per m2										(98c) / (4) =		12.5711	(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	76.1695	46.6005	23.8221	3.5791	0.2721	0.0000	0.0000	0.0000	0.0000	4.3702	33.5744	76.6115	(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)	82.5238	50.4881	25.8094	3.8777	0.2949	0.0000	0.0000	0.0000	0.0000	4.7347	36.3753	83.0027	(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	146.8238	130.1102	139.0872	124.5674	122.2506	111.8074	111.6385	115.2090	115.4989	126.7957	132.3489	145.5391	(64)
Efficiency of water heater	82.6617	81.9914	81.0005	80.0265	79.8180	79.8000	79.8000	79.8000	79.8000	80.0704	81.4708	82.6902	(216)
Fuel for water heating, kWh/month	177.6201	158.6876	171.7116	155.6577	153.1618	140.1095	139.8978	144.3721	144.7355	158.3553	162.4494	176.0052	(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	8.2279	6.6008	5.9432	4.3543	3.3634	2.7479	3.0682	3.9881	5.1802	6.7967	7.6768	8.4566	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.7032	-15.5485	-23.0510	-26.8078	-29.7505	-28.1596	-27.8919	-25.9522	-22.6078	-18.2485	-11.9570	-9.2066	(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	-4.7295	-10.0747	-20.2304	-30.6566	-40.7552	-40.9546	-40.3956	-34.0391	-24.7862	-14.4115	-6.3231	-3.7247	(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													287.1067 (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													1882.7637 (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)													66.4041 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation													-520.9659 (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													1801.3086 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	287.1067	0.2100	60.2924 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1882.7637	0.2100	395.3804 (264)
Space and water heating			455.6728 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	66.4041	0.1443	9.5842 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-249.8847	0.1339	-33.4477
PV Unit electricity exported	-271.0812	0.1257	-34.0702
Total			-67.5179 (269)
Total CO2, kg/year			409.6683 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			19.4300 (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	287.1067	1.1300	324.4306 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1882.7637	1.1300	2127.5229 (278)
Space and water heating			2451.9535 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	66.4041	1.5338	101.8529 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-249.8847	1.4947	-373.4911
PV Unit electricity exported	-271.0812	0.4613	-125.0597
Total			-498.5508 (283)
Total Primary energy kWh/year			2185.3564 (286)
Target Primary Energy Rate (TPER)			103.6700 (287)

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Property Reference	Studio Flat 4			Issued on Date	21/08/2023
Assessment Reference	Baseline	Prop Type Ref	Existing D4		
Property					
SAP Rating	71 C	DER	33.15	TER	17.25
Environmental	85 B	% DER < TER			-92.17
CO ₂ Emissions (t/year)	0.72	DFEE	69.64	TFEE	26.56
Compliance Check	See BREL	% DFEE < TFEE			-162.20
% DPER < TPER	-124.34	DPER	206.39	TPER	92.00
Assessor Details				Assessor ID	V922-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	23.7200 (1b)	x 2.8900 (2b)	= 68.5508 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.7200		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 68.5508 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.2918 (8)
Pressure Test Method	No
Measured/design AP50	Blower Door
Infiltration rate	15.0000 (17)
Number of sides sheltered	1.0418 (18)
	3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8074 (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	1.0294	1.0092	0.9890	0.8881	0.8679	0.7670	0.7670	0.7468	0.8074	0.8679	0.9083	0.9486 (22b)
Effective ac	1.0294	1.0092	0.9891	0.8944	0.8766	0.7941	0.7941	0.7789	0.8259	0.8766	0.9125	0.9500 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			2.6500	1.3258	3.5133		(27)
External Wall 1	24.4500	2.6500	21.8000	0.3000	6.5400	17.0000	370.6000 (29a)
Flat Ceiling	14.8200		14.8200	0.1600	2.3712	9.0000	133.3800 (30)
Total net area of external elements A _{um} (A, m ²)			39.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	12.4245		(33)
Party Wall 1			52.3300	0.0000	0.0000	180.0000	9419.4000 (32)
Party Floor 1			23.7200			30.0000	711.6000 (32d)
Party Ceiling 1			8.9100			20.0000	178.2000 (32b)

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Internal Wall 1 45.2900 9.0000 407.6100 (32c)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 11220.7900 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 473.0519 (35)
 Thermal bridges (Default value 0.200 * total exposed area) 7.8540 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 20.2785 (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	23.2865	22.8299	22.3746	20.2319	19.8310	17.9648	17.9648	17.6192	18.6837	19.8310	20.6420	21.4899 (38)
Heat transfer coeff	43.5649	43.1083	42.6531	40.5104	40.1095	38.2433	38.2433	37.8977	38.9621	40.1095	40.9205	41.7684 (39)
Average = Sum(39)m / 12 =												40.5076

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.8366	1.8174	1.7982	1.7079	1.6910	1.6123	1.6123	1.5977	1.6426	1.6910	1.7251	1.7609 (40)
HLP (average)												1.7077
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.0710 (42)
 Hot water usage for mixer showers 54.0712 53.2587 52.0746 49.8090 48.1371 46.2726 45.2128 46.3879 47.6761 49.6780 51.9922 53.8641 (42a)
 Hot water usage for baths 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)
 Hot water usage for other uses 25.5982 24.6674 23.7366 22.8057 21.8749 20.9440 20.9440 21.8749 22.8057 23.7366 24.6674 25.5982 (42c)
 Average daily hot water use (litres/day) 73.1230 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	79.6695	77.9261	75.8111	72.6147	70.0119	67.2166	66.1568	68.2628	70.4818	73.4146	76.6596	79.4623 (44)
Energy conte 126.1770	110.9657	116.5189	99.4059	94.2495	82.6506	80.0109	84.5236	86.9111	99.6229	109.2157	124.4188 (45)	
Energy content (annual)												1214.6706
Distribution loss (46)m = 0.15 x (45)m	18.9265	16.6449	17.4778	14.9109	14.1374	12.3976	12.0016	12.6785	13.0367	14.9434	16.3824	18.6628 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (59)
Total heat required for water heating calculated for each month												
177.1359	156.9931	167.4778	148.7210	145.2084	131.9657	130.9698	135.4825	136.2262	150.5818	158.5308	175.3777 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	177.1359	156.9931	167.4778	148.7210	145.2084	131.9657	130.9698	135.4825	136.2262	150.5818	158.5308	175.3777 (64)
12Total per year (kWh/year)												1814.6706 (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	54.6936	48.4029	51.4822	45.3812	44.0777	39.8101	39.3434	40.8438	41.2267	45.8643	48.6430	54.1090 (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	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.5178	52.6090	47.5178	49.1017	47.5178	49.1017	47.5178	47.5178	49.1017	47.5178	49.1017	47.5178 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.5506	84.4176	82.2328	77.5817	71.7104	66.1922	62.5057	61.6387	63.8235	68.4747	74.3460	79.8642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551 (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)	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405 (71)
Water heating gains (Table 5)	73.5129	72.0282	69.1966	63.0295	59.2442	55.2918	52.8809	54.8976	57.2593	61.6456	67.5597	72.7271 (72)
Total internal gains	246.6465	251.1200	241.0124	231.7781	220.5376	209.6509	201.9696	203.1193	209.2498	219.7033	233.0726	242.1743 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a	Specific data	g Specific	FF data	Access factor	Gains W
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W/m2													or Table 6b		or Table 6c		Table 6d	
East	2.6500				19.6403				0.7200				0.7000		0.7700		18.1785 (76)	
Solar gains	18.1785	35.5609	58.5638	85.4118	104.6753	107.1538	102.0148	87.6292	68.1121	42.1960	22.6664	14.9491 (83)						
Total gains	264.8249	286.6809	299.5761	317.1898	325.2129	316.8047	303.9844	290.7485	277.3618	261.8993	255.7390	257.1233 (84)						
7. Mean internal temperature (heating season)																		
Temperature during heating periods in the living area from Table 9, Th1 (C)															21.0000 (85)			
Utilisation factor for gains for living area, nil,m (see Table 9a)																		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
tau	71.5458	72.3036	73.0753	76.9404	77.7094	81.5016	81.5016	82.2448	79.9979	77.7094	76.1693	74.6231						
alpha	5.7697	5.8202	5.8717	6.1294	6.1806	6.4334	6.4334	6.4830	6.3332	6.1806	6.0780	5.9749						
util living area	0.9981	0.9966	0.9926	0.9744	0.9124	0.7334	0.5480	0.5907	0.8498	0.9783	0.9957	0.9984 (86)						
MIT	19.8563	19.9899	20.2042	20.5470	20.8088	20.9687	20.9957	20.9935	20.9166	20.5968	20.2156	19.8930 (87)						
Th 2	19.4445	19.4579	19.4713	19.5352	19.5473	19.6043	19.6043	19.6150	19.5823	19.5473	19.5229	19.4975 (88)						
util rest of house	0.9969	0.9943	0.9873	0.9545	0.8463	0.5945	0.3775	0.4182	0.7304	0.9570	0.9923	0.9974 (89)						
MIT 2	18.4673	18.6105	18.8331	19.2149	19.4483	19.5967	19.6040	19.6144	19.5545	19.2761	18.8873	18.5459 (90)						
Living area fraction	fLA = Living area / (4) =																	
MIT	19.3363	19.4735	19.6909	20.0483	20.2995	20.4550	20.4747	20.4772	20.4067	20.1024	19.7183	19.3887 (92)						
Temperature adjustment	-0.1500																	
adjusted MIT	19.1863	19.3235	19.5409	19.8983	20.1495	20.3050	20.3247	20.3272	20.2567	19.9524	19.5683	19.2387 (93)						
8. Space heating requirement																		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Utilisation	0.9966	0.9940	0.9876	0.9606	0.8778	0.6679	0.4667	0.5086	0.7937	0.9646	0.9924	0.9972 (94)						
Useful gains	263.9300	284.9662	295.8709	304.6972	285.4842	211.6033	141.8658	147.8784	220.1493	252.6157	253.8076	256.3912 (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	648.5222	621.7723	556.2335	445.5454	338.9044	218.1794	142.4449	148.8305	239.8767	375.1198	510.2107	628.1412 (97)						
Space heating kWh	286.1366	226.3337	193.7097	101.4107	39.7447	0.0000	0.0000	0.0000	0.0000	91.1430	184.6103	276.5820 (98a)						
Space heating requirement - total per year (kWh/year)	1399.6707																	
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	286.1366	226.3337	193.7097	101.4107	39.7447	0.0000	0.0000	0.0000	0.0000	91.1430	184.6103	276.5820 (98c)						
Space heating requirement after solar contribution - total per year (kWh/year)	1399.6707																	
Space heating per m2	(98c) / (4) = 59.0080 (99)																	
9a. Energy requirements - Individual heating systems, including micro-CHP																		
Fraction of space heat from secondary/supplementary system (Table 11)															0.1000 (201)			
Fraction of space heat from main system(s)															0.9000 (202)			
Efficiency of main space heating system 1 (in %)															79.0000 (206)			
Efficiency of main space heating system 2 (in %)															0.0000 (207)			
Efficiency of secondary/supplementary heating system, %															100.0000 (208)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Space heating requirement	286.1366	226.3337	193.7097	101.4107	39.7447	0.0000	0.0000	0.0000	0.0000	91.1430	184.6103	276.5820 (98)						
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000 (210)						
Space heating fuel (main heating system)	325.9784	257.8485	220.6820	115.5312	45.2787	0.0000	0.0000	0.0000	0.0000	103.8338	210.3155	315.0934 (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)	28.6137	22.6334	19.3710	10.1411	3.9745	0.0000	0.0000	0.0000	0.0000	9.1143	18.4610	27.6582 (215)						
Water heating																		
Water heating requirement	177.1359	156.9931	167.4778	148.7210	145.2084	131.9657	130.9698	135.4825	136.2262	150.5818	158.5308	175.3777 (64)						
Efficiency of water heater (217)m	80.0836	79.8304	79.3354	78.1858	76.6226	75.0000	75.0000	75.0000	75.0000	77.9450	79.3507	80.0305 (217)						
Fuel for water heating, kWh/month	157.5565	139.0017	146.8687	127.1406	123.0049	110.2009	106.6812	112.6981	115.8815	127.8117	137.6367	155.4642 (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	55.4858	50.1162	55.4858	53.6959	55.4858	53.6959	55.4858	55.4858	53.6959	55.4858	53.6959	55.4858 (231)						
Lighting	9.8733	7.9207	7.1317	5.2250	4.0359	3.2974	3.6817	4.7856	6.2161	8.1558	9.2120	10.1477 (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)																		

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(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(235d)m	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												1594.5615	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												139.9671	(215)
Efficiency of water heater												75.0000	
Water heating fuel used												1559.9467	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												53.3000	(230c)
maintaining electric keep-hot facility for gas combi boiler												600.0000	(230f)
Total electricity for the above, kWh/year												653.3000	(231)
Electricity for lighting (calculated in Appendix L)												79.6828	(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												4027.4581	(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	1594.5615	0.2100	334.8579	(261)
Total CO2 associated with community systems			0.0000	(373)
Space heating - secondary	139.9671	0.1555	21.7594	(263)
Water heating (other fuel)	1559.9467	0.2100	327.5888	(264)
Space and water heating			684.2061	(265)
Pumps, fans and electric keep-hot	653.3000	0.1387	90.6208	(267)
Energy for lighting	79.6828	0.1443	11.5007	(268)
Total CO2, kg/year			786.3276	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			33.1500	(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	1594.5615	1.1300	1801.8545	(275)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	139.9671	1.5756	220.5275	(277)
Water heating (other fuel)	1559.9467	1.1300	1762.7398	(278)
Space and water heating			3785.1218	(279)
Pumps, fans and electric keep-hot	653.3000	1.5128	988.3122	(281)
Energy for lighting	79.6828	1.5338	122.2202	(282)
Total Primary energy kWh/year			4895.6542	(286)
Dwelling Primary energy Rate (DPER)			206.3900	(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	23.7200	(1b)	x	2.8900 (2b) = 68.5508 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.7200			
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	68.5508 (5)

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2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =		0.2918 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.5418 (18)
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.4199 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (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												
	0.5353	0.5248	0.5143	0.4618	0.4513	0.3989	0.3989	0.3884	0.4199	0.4513	0.4723	0.4933 (22b)
Effective ac	0.6433	0.6377	0.6323	0.6067	0.6019	0.5795	0.5795	0.5754	0.5881	0.6019	0.6116	0.6217 (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)			2.6500	1.1450	3.0344		(27)
External Wall 1	24.4500	2.6500	21.8000	0.1800	3.9240		(29a)
Flat Ceiling	14.8200		14.8200	0.1100	1.6302		(30)
Total net area of external elements Aum(A, m2)			39.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 8.5886		(33)
Party Wall 1			52.3300	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							476.8082 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							1.9635 (36)
Point Thermal bridges						(36a) = 0.0000	
Total fabric heat loss						(33) + (36) + (36a) = 10.5521	(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	14.5522	14.4264	14.3030	13.7235	13.6151	13.1104	13.1104	13.0169	13.3048	13.6151	13.8344	14.0637 (38)
Heat transfer coeff	25.1043	24.9784	24.8550	24.2756	24.1671	23.6624	23.6624	23.5690	23.8568	24.1671	24.3865	24.6158 (39)
Average = Sum(39)m / 12 =												24.2750

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0584	1.0531	1.0479	1.0234	1.0189	0.9976	0.9976	0.9936	1.0058	1.0189	1.0281	1.0378 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.0710 (42)											
Hot water usage for mixer showers	54.0712	53.2587	52.0746	49.8090	48.1371	46.2726	45.2128	46.3879	47.6761	49.6780	51.9922	53.8641 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.5982	24.6674	23.7366	22.8057	21.8749	20.9440	20.9440	21.8749	22.8057	23.7366	24.6674	25.5982 (42c)
Average daily hot water use (litres/day)												73.1230 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	79.6695	77.9261	75.8111	72.6147	70.0119	67.2166	66.1568	68.2628	70.4818	73.4146	76.6596	79.4623 (44)
Energy conte	126.1770	110.9657	116.5189	99.4059	94.2495	82.6506	80.0109	84.5236	86.9111	99.6229	109.2157	124.4188 (45)
Energy content (annual)										Total = Sum(45)m = 1214.6706		
Distribution loss (46)m = 0.15 x (45)m	18.9265	16.6449	17.4778	14.9109	14.1374	12.3976	12.0016	12.6785	13.0367	14.9434	16.3824	18.6628 (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	40.5987	35.8673	38.6325	35.8100	35.6773	33.1479	33.7128	34.7860	34.7581	37.4113	37.8047	40.4931 (61)

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Total heat required for water heating calculated for each month

WWHRS	166.7757	146.8330	155.1514	135.2159	129.9269	115.7985	113.7237	119.3095	121.6692	137.0341	147.0204	164.9119 (62)
PV diverter	-24.7191	-21.8618	-22.8924	-18.9558	-17.6661	-15.1170	-14.1698	-15.0682	-15.6407	-18.4386	-20.8887	-24.2614 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	142.0566	124.9712	132.2590	116.2601	112.2607	100.6815	99.5539	104.2414	106.0286	118.5955	126.1317	140.6506 (64)
Electric shower(s)	Total per year (kWh/year) = Sum(64)m =											1423.6907 (64)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											1424 (64)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	52.1035	45.8629	48.4007	42.0050	40.2573	35.7683	35.0318	36.8006	37.5875	42.4774	45.7654	51.4925 (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	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.5178	52.6090	47.5178	49.1017	47.5178	49.1017	47.5178	47.5178	49.1017	47.5178	49.1017	47.5178 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	83.5506	84.4176	82.2328	77.5817	71.7104	66.1922	62.5057	61.6387	63.8235	68.4747	74.3460	79.8642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551 (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)	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405 (71)
Water heating gains (Table 5)	70.0316	68.2484	65.0546	58.3402	54.1093	49.6782	47.0858	49.4631	52.2048	57.0933	63.5631	69.2104 (72)
Total internal gains	243.1652	247.3402	236.8704	227.0888	215.4026	204.0373	196.1745	197.6849	204.1953	215.1510	229.0760	238.6575 (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			2.6500	19.6403	0.6300	0.7000	0.7700	15.9061 (76)				
Solar gains	15.9061	31.1158	51.2433	74.7353	91.5909	93.7596	89.2629	76.6755	59.5981	36.9215	19.8331	13.0804 (83)
Total gains	259.0714	278.4560	288.1137	301.8241	306.9935	297.7969	285.4374	274.3604	263.7933	252.0725	248.9091	251.7380 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	125.1435	125.7741	126.3984	129.4156	129.9962	132.7689	132.7689	133.2954	131.6870	129.9962	128.8270	127.6270
alpha	9.3429	9.3849	9.4266	9.6277	9.6664	9.8513	9.8513	9.8864	9.7791	9.6664	9.5885	9.5085
util living area	0.9957	0.9900	0.9731	0.8931	0.7221	0.5082	0.3647	0.3951	0.6217	0.9049	0.9857	0.9965 (86)
MIT	20.5714	20.6637	20.7870	20.9355	20.9918	20.9997	21.0000	21.0000	20.9983	20.9380	20.7504	20.5667 (87)
Th 2	20.0350	20.0394	20.0436	20.0639	20.0677	20.0854	20.0854	20.0886	20.0785	20.0677	20.0600	20.0520 (88)
util rest of house	0.9932	0.9844	0.9586	0.8502	0.6547	0.4358	0.2889	0.3169	0.5401	0.8567	0.9766	0.9944 (89)
MIT 2	19.5654	19.6844	19.8373	20.0146	20.0634	20.0853	20.0854	20.0886	20.0780	20.0236	19.8104	19.5739 (90)
Living area fraction	20.1948	20.2971	20.4315	20.5908	20.6443	20.6574	20.6576	20.6588	20.6538	20.5957	20.3985	20.1950 (91)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (92)
adjusted MIT	20.1948	20.2971	20.4315	20.5908	20.6443	20.6574	20.6576	20.6588	20.6538	20.5957	20.3985	20.1950 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9937	0.9862	0.9652	0.8757	0.6969	0.4811	0.3364	0.3658	0.5913	0.8858	0.9804	0.9948 (94)
Ext temp.	257.4464	274.6111	278.0880	264.2929	213.9514	143.2775	96.0109	100.3726	155.9689	223.2872	244.0358	250.4349 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	399.0269	384.5942	346.2676	283.7998	216.1572	143.3329	96.0122	100.3756	156.3527	241.5670	324.3028	393.7301 (97)
Space heating requirement - total per year (kWh/year)	105.3359	73.9086	50.7256	14.0450	1.6411	0.0000	0.0000	0.0000	0.0000	13.6002	57.7922	106.6116 (98a)
Solar heating kWh												423.6602
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)

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Space heating kWh	105.3359	73.9086	50.7256	14.0450	1.6411	0.0000	0.0000	0.0000	0.0000	13.6002	57.7922	106.6116 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												423.6602
Space heating per m2												(98c) / (4) = 17.8609 (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	105.3359	73.9086	50.7256	14.0450	1.6411	0.0000	0.0000	0.0000	0.0000	13.6002	57.7922	106.6116 (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)	113.9999	79.9877	54.8979	15.2002	1.7760	0.0000	0.0000	0.0000	0.0000	14.7188	62.5457	115.3805 (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	142.0566	124.9712	132.2590	116.2601	112.2607	100.6815	99.5539	104.2414	106.0286	118.5955	126.1317	140.6506 (64)
Efficiency of water heater	83.7496	83.2944	82.5127	81.1461	80.4121	80.3000	80.3000	80.3000	80.3000	81.1072	82.8174	80.3000 (216)
Fuel for water heating, kWh/month	169.6206	150.0355	160.2892	143.2726	139.6068	125.3817	123.9774	129.8149	132.0406	146.2207	152.3010	83.7951 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	9.8733	7.9207	7.1317	5.2250	4.0359	3.2974	3.6817	4.7856	6.2161	8.1558	9.2120	10.1477 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.9252	-17.2570	-25.4788	-29.4967	-32.6093	-30.8131	-30.5204	-28.4646	-24.8915	-20.1994	-13.2992	-10.2653 (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	-5.4402	-11.5752	-23.2230	-35.1643	-46.7264	-46.9569	-46.3192	-39.0399	-28.4380	-16.5509	-7.2703	-4.2855 (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												458.5067 (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												1740.4114 (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)												79.6828 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-586.2102 (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												1778.3907 (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	458.5067	0.2100	96.2864 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1740.4114	0.2100	365.4864 (264)
Space and water heating			461.7728 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	79.6828	0.1443	11.5007 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-275.2204	0.1339	-36.8643

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PV Unit electricity exported	-310.9898	0.1257	-39.0921
Total			-75.9564 (269)
Total CO2, kg/year			409.2464 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.2500 (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	458.5067	1.1300	518.1126 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)			1966.6649 (278)
Space and water heating	1740.4114	1.1300	2484.7775 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	79.6828	1.5338	122.2202 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-275.2204	1.4950	-411.4545
PV Unit electricity exported	-310.9898	0.4614	-143.4932
Total			-554.9477 (283)
Total Primary energy kWh/year			2182.1507 (286)
Target Primary Energy Rate (TPER)			92.0000 (287)

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Property Reference	Studio Flat 4				Issued on Date	21/08/2023
Assessment Reference	Proposed		Prop Type Ref		Existing D4	
Property						
SAP Rating	77 C	DER	5.74	TER	17.50	
Environmental	97 A	% DER < TER				87.20
CO ₂ Emissions (t/year)	0.12	DFEE	41.74	TFEE	26.56	
Compliance Check	See BREL	% DFEE < TFEE				-57.16
% DPER < TPER	35.80	DPER	59.91	TPER	93.31	
Assessor Details					Assessor ID	V922-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	23.7200 (1b)	x 2.8900 (2b)	= 68.5508 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.7200		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 68.5508 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.2918 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.5418 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4199 (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	0.5353	0.5248	0.5143	0.4618	0.4513	0.3989	0.3989	0.3884	0.4199	0.4513	0.4723	0.4933 (22b)
Effective ac	0.6433	0.6377	0.6323	0.6067	0.6019	0.5795	0.5795	0.5754	0.5881	0.6019	0.6116	0.6217 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			2.6500	1.3258	3.5133		(27)
External Wall 1	24.4500	2.6500	21.8000	0.1800	3.9240	17.0000	370.6000 (29a)
Flat Ceiling	14.8200		14.8200	0.1100	1.6302	9.0000	133.3800 (30)
Total net area of external elements A _{um} (A, m ²)			39.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		9.0675		(33)
Party Wall 1			52.3300	0.0000	0.0000	180.0000	9419.4000 (32)
Party Floor 1			23.7200			30.0000	711.6000 (32d)
Party Ceiling 1			8.9100			20.0000	178.2000 (32b)

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Internal Wall 1 45.2900 9.0000 407.6100 (32c)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 11220.7900 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 473.0519 (35)
 Thermal bridges (Default value 0.200 * total exposed area) 7.8540 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 16.9215 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
 (38)m Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 14.5522 14.4264 14.3030 13.7235 13.6151 13.1104 13.1104 13.0169 13.3048 13.6151 13.8344 14.0637 (38)
 Heat transfer coeff 31.4737 31.3478 31.2244 30.6450 30.5365 30.0318 30.0318 29.9384 30.2262 30.5365 30.7559 30.9852 (39)
 Average = $\text{Sum}(39)m / 12 =$ 30.6444

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 1.3269 1.3216 1.3164 1.2919 1.2874 1.2661 1.2661 1.2622 1.2743 1.2874 1.2966 1.3063 (40)
 HLP (average) 1.2919
 Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.0710 (42)
 Hot water usage for mixer showers 54.0712 53.2587 52.0746 49.8090 48.1371 46.2726 45.2128 46.3879 47.6761 49.6780 51.9922 53.8641 (42a)
 Hot water usage for baths 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)
 Hot water usage for other uses 25.5982 24.6674 23.7366 22.8057 21.8749 20.9440 20.9440 21.8749 22.8057 23.7366 24.6674 25.5982 (42c)
 Average daily hot water use (litres/day) 73.1230 (43)

Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 79.6695 77.9261 75.8111 72.6147 70.0119 67.2166 66.1568 68.2628 70.4818 73.4146 76.6596 79.4623 (44)
 Energy conte 126.1770 110.9657 116.5189 99.4059 94.2495 82.6506 80.0109 84.5236 86.9111 99.6229 109.2157 124.4188 (45)
 Energy content (annual) Total = $\text{Sum}(45)m =$ 1214.6706
 Distribution loss (46)m = 0.15 x (45)m 18.9265 16.6449 17.4778 14.9109 14.1374 12.3976 12.0016 12.6785 13.0367 14.9434 16.3824 18.6628 (46)

Water storage loss:
 Store volume 110.0000 (47)
 b) If manufacturer declared loss factor is not known :
 Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (51)
 Volume factor from Table 2a 1.0294 (52)
 Temperature factor from Table 2b 0.6000 (53)
 Enter (49) or (54) in (55) 1.0327 (55)
 Total storage loss 32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (56)

If cylinder contains dedicated solar storage 32.0144 28.9162 32.0144 30.9817 32.0144 30.9817 32.0144 32.0144 30.9817 32.0144 30.9817 32.0144 (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 181.4538 160.8931 171.7957 152.8996 149.5263 136.1443 135.2877 139.8004 140.4048 154.8997 162.7094 179.6956 (62)
 WHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)
 PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
 Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)
 FGHS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
 Output from w/h 181.4538 160.8931 171.7957 152.8996 149.5263 136.1443 135.2877 139.8004 140.4048 154.8997 162.7094 179.6956 (64)
 Total per year (kWh/year) = $\text{Sum}(64)m =$ 1865.5104 (64)
 1866 (64)

12Total per year (kWh/year)
 Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = $\text{Sum}(64a)m =$ 0.0000 (64a)
 Heat gains from water heating, kWh/month 86.1753 76.8380 82.9640 75.8474 75.5594 70.2763 70.8251 72.3255 71.6929 77.3460 79.1092 85.5907 (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 53.5506 53.5506 53.5506 53.5506 53.5506 53.5506 53.5506 53.5506 53.5506 53.5506 53.5506 53.5506 (66)
 Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 47.5178 52.6090 47.5178 49.1017 47.5178 49.1017 47.5178 47.5178 49.1017 47.5178 49.1017 47.5178 (67)
 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 83.5506 84.4176 82.2328 77.5817 71.7104 66.1922 62.5057 61.6387 63.8235 68.4747 74.3460 79.8642 (68)
 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 28.3551 28.3551 28.3551 28.3551 28.3551 28.3551 28.3551 28.3551 28.3551 28.3551 28.3551 28.3551 (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) -42.8405 -42.8405 -42.8405 -42.8405 -42.8405 -42.8405 -42.8405 -42.8405 -42.8405 -42.8405 -42.8405 -42.8405 (71)
 Water heating gains (Table 5) 115.8270 114.3423 111.5107 105.3436 101.5584 97.6059 95.1950 97.2117 99.5735 103.9597 109.8738 115.0413 (72)
 Total internal gains 285.9606 290.4341 280.3265 271.0922 259.8517 251.9651 244.2837 245.4335 251.5639 259.0174 272.3867 281.4884 (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				2.6500	19.6403		0.7200		0.7000		0.7700		18.1785 (76)
Solar gains	18.1785	35.5609	58.5638	85.4118	104.6753	107.1538	102.0148	87.6292	68.1121	42.1960	22.6664	14.9491	(83)
Total gains	304.1391	325.9950	338.8903	356.5039	364.5270	359.1189	346.2985	333.0627	319.6760	301.2135	295.0531	296.4375	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	99.0315	99.4291	99.8220	101.7096	102.0707	103.7861	103.7861	104.1101	103.1185	102.0707	101.3428	100.5928
alpha	7.6021	7.6286	7.6548	7.7806	7.8047	7.9191	7.9191	7.9407	7.8746	7.8047	7.7562	7.7062
util living area	0.9934	0.9871	0.9702	0.9027	0.7515	0.5334	0.3815	0.4133	0.6444	0.9084	0.9818	0.9943 (86)
MIT	20.4187	20.5240	20.6772	20.8722	20.9737	20.9983	20.9999	20.9998	20.9933	20.8852	20.6404	20.4115 (87)
Th 2	19.8198	19.8240	19.8280	19.8471	19.8507	19.8675	19.8675	19.8706	19.8610	19.8507	19.8435	19.8359 (88)
util rest of house	0.9895	0.9798	0.9536	0.8574	0.6714	0.4401	0.2834	0.3119	0.5426	0.8560	0.9702	0.9911 (89)
MIT 2	19.1940	19.3284	19.5173	19.7473	19.8368	19.8670	19.8675	19.8706	19.8588	19.7681	19.4897	19.1981 (90)
Living area fraction									fLA = Living area / (4) =			0.6256 (91)
MIT	19.9602	20.0764	20.2430	20.4510	20.5481	20.5748	20.5760	20.5771	20.5686	20.4670	20.2096	19.9572 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9602	20.0764	20.2430	20.4510	20.5481	20.5748	20.5760	20.5771	20.5686	20.4670	20.2096	19.9572 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9901	0.9817	0.9603	0.8829	0.7213	0.4986	0.3448	0.3754	0.6066	0.8866	0.9745	0.9915 (94)
Useful gains	301.1252	320.0270	325.4510	314.7723	262.9159	179.0650	119.3882	125.0217	193.9185	267.0433	287.5426	293.9146 (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	492.8849	475.7464	429.1172	353.9815	270.1904	179.4347	119.4052	125.0544	195.5204	301.3046	403.1974	488.2401 (97)
Space heating kWh	142.6692	104.6435	77.1276	28.2306	5.4122	0.0000	0.0000	0.0000	0.0000	25.4904	83.2715	144.5781 (98a)
Space heating requirement - total per year (kWh/year)												611.4232
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	142.6692	104.6435	77.1276	28.2306	5.4122	0.0000	0.0000	0.0000	0.0000	25.4904	83.2715	144.5781 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												611.4232
Space heating per m2										(98c) / (4) =		25.7767 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (301)
Fraction of space heat from community system												0.9000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating:												
Space heating requirement	142.6692	104.6435	77.1276	28.2306	5.4122	0.0000	0.0000	0.0000	0.0000	25.4904	83.2715	144.5781 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	192.6034	141.2687	104.1223	38.1114	7.3065	0.0000	0.0000	0.0000	0.0000	34.4120	112.4165	195.1805
Space heating requirement	192.6034	141.2687	104.1223	38.1114	7.3065	0.0000	0.0000	0.0000	0.0000	34.4120	112.4165	195.1805 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												100.0000 (308)
Space heating fuel for secondary/supplementary system	14.2669	10.4643	7.7128	2.8231	0.5412	0.0000	0.0000	0.0000	0.0000	2.5490	8.3272	14.4578 (309)
Water heating												
Annual water heating requirement	181.4538	160.8931	171.7957	152.8996	149.5263	136.1443	135.2877	139.8004	140.4048	154.8997	162.7094	179.6956 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	272.1807	241.3397	257.6935	229.3494	224.2895	204.2165	202.9316	209.7006	210.6072	232.3495	244.0641	269.5434
Water heating fuel	272.1807	241.3397	257.6935	229.3494	224.2895	204.2165	202.9316	209.7006	210.6072	232.3495	244.0641	269.5434 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
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 (331)
Lighting	9.8733	7.9207	7.1317	5.2250	4.0359	3.2974	3.6817	4.7856	6.2161	8.1558	9.2120	10.1477 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												

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(333a)m	-14.4732	-20.1269	-28.2725	-31.0548	-33.1716	-30.9378	-30.6574	-29.0225	-26.1839	-22.5224	-15.7805	-12.5809	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												825.4213	(307)
Space heating fuel - secondary												61.1423	(309)
Water heating fuel - community heating												2798.2655	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												8.2542	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(331)
Electricity for lighting (calculated in Appendix L)												79.6828	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-294.7844	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												3469.7275	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1035.3391	0.1573	37.0891 (367)
Electrical energy for heat distribution (space & water)	8.2542	0.0000	5.2322 (372)
Overall CO2 factor for heat network			0.0427 (386)
Total CO2 associated with community systems			154.7244 (373)
Space heating - secondary	61.1423	0.1573	9.6157 (374)
Space and water heating			164.3401 (376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (378)
Energy for lighting	79.6828	0.1443	11.5007 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-294.7844	0.1350	-39.7817
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-39.7817 (380)
Total CO2, kg/year			136.0591 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.7400 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1035.3391	1.5822	373.1431 (467)
Electrical energy for heat distribution (space & water)	8.2542	0.0000	55.5891 (472)
Overall CO2 factor for heat network			0.4536 (486)
Total CO2 associated with community systems			1643.8503 (473)
Space heating - secondary	61.1423	1.5822	96.7408 (374)
Space and water heating			1740.5911 (476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (478)
Energy for lighting	79.6828	1.5338	122.2202 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-294.7844	1.4988	-441.8166
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-441.8166 (480)
Total Primary energy kWh/year			1420.9947 (483)
Dwelling Primary energy Rate (DPER)			59.9100 (484)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	23.7200 (1b)	x 2.8900 (2b)	= 68.5508 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	68.5508 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.2918 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.5418 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4199 (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	0.5353	0.5248	0.5143	0.4618	0.4513	0.3989	0.3989	0.3884	0.4199	0.4513	0.4723	0.4933 (22b)
Effective ac	0.6433	0.6377	0.6323	0.6067	0.6019	0.5795	0.5795	0.5754	0.5881	0.6019	0.6116	0.6217 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			2.6500	1.1450	3.0344		(27)
External Wall 1	24.4500	2.6500	21.8000	0.1800	3.9240		(29a)
Flat Ceiling	14.8200		14.8200	0.1100	1.6302		(30)
Total net area of external elements Aum(A, m ²)			39.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	8.5886			(33)
Party Wall 1			52.3300	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	476.8082 (35)
Thermal bridges (User defined value 0.050 * total exposed area)	1.9635 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 10.5521 (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	14.5522	14.4264	14.3030	13.7235	13.6151	13.1104	13.1104	13.0169	13.3048	13.6151	13.8344	14.0637 (38)
Heat transfer coeff	25.1043	24.9784	24.8550	24.2756	24.1671	23.6624	23.6624	23.5690	23.8568	24.1671	24.3865	24.6158 (39)
Average = Sum(39)m / 12 =												24.2750

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0584	1.0531	1.0479	1.0234	1.0189	0.9976	0.9976	0.9936	1.0058	1.0189	1.0281	1.0378 (40)
HLP (average)												1.0234
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0710 (42)
Hot water usage for mixer showers	54.0712	53.2587	52.0746	49.8090	48.1371	46.2726	45.2128	46.3879	47.6761	49.6780	51.9922	53.8641 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.5982	24.6674	23.7366	22.8057	21.8749	20.9440	20.9440	21.8749	22.8057	23.7366	24.6674	25.5982 (42c)
Average daily hot water use (litres/day)												73.1230 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	79.6695	77.9261	75.8111	72.6147	70.0119	67.2166	66.1568	68.2628	70.4818	73.4146	76.6596	79.4623 (44)
Energy content (annual)	126.1770	110.9657	116.5189	99.4059	94.2495	82.6506	80.0109	84.5236	86.9111	99.6229	109.2157	124.4188 (45)
Distribution loss (46)m = 0.15 x (45)m	18.9265	16.6449	17.4778	14.9109	14.1374	12.3976	12.0016	12.6785	13.0367	14.9434	16.3824	18.6628 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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												
	172.7719	153.0514	163.1138	144.4978	140.8444	127.7425	126.6058	131.1185	132.0029	146.2178	154.3075	171.0137 (62)
WWHRS	-24.7191	-21.8618	-22.8924	-18.9558	-17.6661	-15.1170	-14.1698	-15.0682	-15.6407	-18.4386	-20.8887	-24.2614 (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												
	148.0528	131.1896	140.2214	125.5419	123.1783	112.6254	112.4360	116.0503	116.3623	127.7791	133.4188	146.7523 (64)
12Total per year (kWh/year)												1533.6083 (64)
Electric shower(s)												1534 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	79.2298	70.5647	76.0184	69.1259	68.6139	63.5548	63.8796	65.3800	64.9714	70.4005	72.3877	78.6452 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506	53.5506 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	47.5178	52.0090	47.5178	49.1017	47.5178	49.1017	47.5178	47.5178	49.1017	47.5178	49.1017	47.5178 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	83.5506	84.4176	82.2328	77.5817	71.7104	66.1922	62.5057	61.6387	63.8235	68.4747	74.3460	79.8642 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551	28.3551 (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)												
	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405	-42.8405 (71)
Water heating gains (Table 5)												
	106.4916	105.0069	102.1753	96.0083	92.2230	88.2706	85.8596	87.8764	90.2381	94.6244	100.5385	105.7059 (72)
Total internal gains												
	279.6252	284.0987	273.9911	264.7568	253.5163	242.6297	234.9483	236.0981	242.2285	252.6821	266.0514	275.1530 (73)

6. Solar gains

[Jan]												
	Area	Solar flux										
	m2	Table 6a										
		W/m2										
East	2.6500	19.6403										
Solar gains	15.9061	31.1158	51.2433	74.7353	91.5909	93.7596	89.2629	76.6755	59.5981	36.9215	19.8331	13.0804 (83)
Total gains	295.5314	315.2145	325.2344	339.4921	345.1072	336.3893	324.2113	312.7736	301.8266	289.6036	285.8844	288.2335 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	125.1435	125.7741	126.3984	129.4156	129.9962	132.7689	132.7689	133.2954	131.6870	129.9962	128.8270	127.6270
alpha	9.3429	9.3849	9.4266	9.6277	9.6664	9.8513	9.8513	9.8864	9.7791	9.6664	9.5885	9.5085
util living area												
	0.9884	0.9761	0.9436	0.8284	0.6476	0.4501	0.3211	0.3466	0.5447	0.8305	0.9634	0.9900 (86)
MIT	20.6621	20.7488	20.8576	20.9666	20.9967	20.9999	21.0000	21.0000	20.9995	20.9711	20.8305	20.6585 (87)
Th 2	20.0350	20.0394	20.0436	20.0639	20.0677	20.0854	20.0854	20.0886	20.0785	20.0677	20.0600	20.0520 (88)
util rest of house												
	0.9824	0.9645	0.9189	0.7780	0.5846	0.3858	0.2544	0.2780	0.4724	0.7716	0.9442	0.9847 (89)
MIT 2	19.6780	19.7864	19.9147	20.0403	20.0660	20.0853	20.0854	20.0886	20.0784	20.0493	19.9023	19.6884 (90)
Living area fraction												
	20.2937	20.3885	20.5046	20.6199	20.6483	20.6575	20.6576	20.6588	20.6546	20.6260	20.4830	20.2954 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2937	20.3885	20.5046	20.6199	20.6483	20.6575	20.6576	20.6588	20.6546	20.6260	20.4830	20.2954 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9843	0.9692	0.9318	0.8088	0.6241	0.4260	0.2961	0.3209	0.5177	0.8080	0.9538	0.9863	(94)
Useful gains	290.8831	305.5214	303.0466	274.5800	215.3667	143.3174	96.0119	100.3750	156.2513	234.0021	272.6736	284.2802	(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	401.5104	386.8784	348.0855	284.5060	216.2537	143.3358	96.0123	100.3759	156.3729	242.3000	326.3647	396.1995	(97)
Space heating kWh	82.3067	54.6719	33.5089	7.1467	0.6599	0.0000	0.0000	0.0000	0.0000	6.1736	38.6576	83.2679	(98a)
Space heating requirement - total per year (kWh/year)												306.3933	
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	82.3067	54.6719	33.5089	7.1467	0.6599	0.0000	0.0000	0.0000	0.0000	6.1736	38.6576	83.2679	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												306.3933	
Space heating per m2										(98c) / (4) =		12.9171	(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	82.3067	54.6719	33.5089	7.1467	0.6599	0.0000	0.0000	0.0000	0.0000	6.1736	38.6576	83.2679	(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)	89.1730	59.2329	36.3044	7.7429	0.7149	0.0000	0.0000	0.0000	0.0000	6.6886	41.8826	90.2144	(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	148.0528	131.1896	140.2214	125.5419	123.1783	112.6254	112.4360	116.0503	116.3623	127.7791	133.4188	146.7523	(64)
Efficiency of water heater	82.7983	82.2522	81.3911	80.2380	79.8431	79.8000	79.8000	79.8000	79.8000	80.1745	81.6593	82.8393	(216)
Fuel for water heating, kWh/month	178.8113	159.4968	172.2810	156.4619	154.2754	141.1346	140.8972	145.4264	145.8174	159.3763	163.3847	177.1530	(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	9.8733	7.9207	7.1317	5.2250	4.0359	3.2974	3.6817	4.7856	6.2161	8.1558	9.2120	10.1477	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-11.9252	-17.2570	-25.4788	-29.4967	-32.6093	-30.8131	-30.5204	-28.4646	-24.8915	-20.1994	-13.2992	-10.2653	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-5.4402	-11.5752	-23.2230	-35.1643	-46.7264	-46.9569	-46.3192	-39.0399	-28.4380	-16.5509	-7.2703	-4.2855	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													331.9538 (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													1894.5161 (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)													79.6828 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation													-586.2102 (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													1805.9425 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	331.9538	0.2100	69.7103 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1894.5161	0.2100	397.8484 (264)
Space and water heating			467.5587 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	79.6828	0.1443	11.5007 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-275.2204	0.1339	-36.8643
PV Unit electricity exported	-310.9898	0.1257	-39.0921
Total			-75.9564 (269)
Total CO2, kg/year			415.0323 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.5000 (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	331.9538	1.1300	375.1077 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1894.5161	1.1300	2140.8032 (278)
Space and water heating			2515.9110 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	79.6828	1.5338	122.2202 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-275.2204	1.4950	-411.4545
PV Unit electricity exported	-310.9898	0.4614	-143.4932
Total			-554.9477 (283)
Total Primary energy kWh/year			2213.2843 (286)
Target Primary Energy Rate (TPER)			93.3100 (287)

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Property Reference	Studio Flat 5				Issued on Date	21/08/2023
Assessment Reference	Baseline		Prop Type Ref	New 05		
Property						
SAP Rating	72 C	DER	32.25	TER	20.00	
Environmental	87 B	% DER < TER				-61.25
CO ₂ Emissions (t/year)	0.61	DFEE	57.42	TFEE	30.60	
Compliance Check	See BREL	% DFEE < TFEE				-87.09
% DPER < TPER	-90.73	DPER	203.68	TPER	106.79	
Assessor Details					Assessor ID	V922-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	20.5600 (1b)	x 2.4000 (2b)	= 49.3440 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	20.5600		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 49.3440 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.4053 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	8.0000 (17)
Number of sides sheltered	0.8053 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.6845 (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	0.8728	0.8557	0.8385	0.7530	0.7359	0.6503	0.6503	0.6332	0.6845	0.7359	0.7701	0.8043 (22b)
Effective ac	0.8809	0.8661	0.8516	0.7835	0.7707	0.7114	0.7114	0.7005	0.7343	0.7707	0.7965	0.8235 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			3.6700	1.3258	4.8655		(27)
External Wall 1	23.9600	3.6700	20.2900	0.1800	3.6522	150.0000	3043.5000 (29a)
External Roof 1	20.5600		20.5600	0.1500	3.0840	9.0000	185.0400 (30)
Total net area of external elements A _{um} (A, m ²)			44.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	11.6017		(33)
Party Wall 1			23.9600	0.0000	0.0000	180.0000	4312.8000 (32)
Party Floor 1			20.5600			40.0000	822.4000 (32d)
Internal Wall 1			58.6100			9.0000	527.4900 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
 Thermal bridges (Default value $0.200 \times \text{total exposed area}$)
 Point Thermal bridges
 Total fabric heat loss

$(28) \dots (30) + (32) + (32a) \dots (32e) = 8891.2300 \text{ (34)}$
 432.4528 (35)
 8.9040 (36)
 $(36a) = 0.0000$
 $(33) + (36) + (36a) = 20.5057 \text{ (37)}$

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	14.3435	14.1026	13.8666	12.7579	12.5504	11.5848	11.5848	11.4059	11.9567	12.5504	12.9701	13.4088 (38)
Heat transfer coeff	34.8492	34.6084	34.3723	33.2636	33.0562	32.0905	32.0905	31.9117	32.4625	33.0562	33.4758	33.9145 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$												33.2626
HLP	1.6950	1.6833	1.6718	1.6179	1.6078	1.5608	1.5608	1.5521	1.5789	1.6078	1.6282	1.6495 (40)
HLP (average)												1.6178
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0357 (42)
Hot water usage for mixer showers	53.3080	52.5068	51.3395	49.1059	47.4576	45.6194	44.5745	45.7331	47.0031	48.9767	51.2583	53.1037 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.2365	24.3188	23.4011	22.4835	21.5658	20.6481	20.6481	21.5658	22.4835	23.4011	24.3188	25.2365 (42c)
Average daily hot water use (litres/day)												72.0905 (43)
Daily hot water use	78.5445	76.8257	74.7406	71.5893	69.0233	66.2674	65.2226	67.2989	69.4865	72.3779	75.5771	78.3402 (44)
Energy content (annual)	124.3953	109.3988	114.8735	98.0022	92.9187	81.4836	78.8811	83.3300	85.6838	98.2161	107.6735	122.6619 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	18.6593	16.4098	17.2310	14.7003	13.9378	12.2225	11.8322	12.4995	12.8526	14.7324	16.1510	18.3993 (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	175.3542	155.4261	165.8324	147.3173	143.8776	130.7986	129.8400	134.2889	134.9989	149.1750	156.9885	173.6208 (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	175.3542	155.4261	165.8324	147.3173	143.8776	130.7986	129.8400	134.2889	134.9989	149.1750	156.9885	173.6208 (64)
12Total per year (kWh/year)												1797.5185 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = $\text{Sum}(64a)\text{m} =$												0.0000 (64a)
Heat gains from water heating, kWh/month	54.1012	47.8819	50.9352	44.9145	43.6352	39.4220	38.9677	40.4470	40.8186	45.3966	48.1302	53.5248 (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	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.6588	43.9080	39.6588	40.9808	39.6588	40.9808	39.6588	39.6588	40.9808	39.6588	40.9808	39.6588 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	76.8802	77.6780	75.6676	71.3878	65.9852	60.9076	57.5155	56.7177	58.7281	63.0079	68.4104	73.4880 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785 (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)	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277 (71)
Water heating gains (Table 5)	72.7166	71.2529	68.4613	62.3813	58.6494	54.7528	52.3759	54.3642	56.6926	61.0169	66.8475	71.9419 (72)
Total internal gains	230.7910	234.3742	225.3231	216.2852	205.8289	195.1766	188.0856	189.2761	194.9368	205.2190	217.7741	226.6242 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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West													3.6700	19.6403	0.7200	0.7000	0.7700	25.1754 (80)
Solar gains	25.1754	49.2485	81.1053	118.2872	144.9654	148.3979	141.2809	121.3582	94.3288	58.4375	31.3908	20.7031 (83)						
Total gains	255.9665	283.6227	306.4284	334.5724	350.7943	343.5746	329.3665	310.6343	289.2656	263.6565	249.1649	247.3273 (84)						
7. Mean internal temperature (heating season)																		
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)					
Utilisation factor for gains for living area, nil,m (see Table 9a)																		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
tau	70.8707	71.3638	71.8539	74.2489	74.7149	76.9632	76.9632	77.3944	76.0813	74.7149	73.7782	72.8238						
alpha	5.7247	5.7576	5.7903	5.9499	5.9810	6.1309	6.1309	6.1596	6.0721	5.9810	5.9185	5.8549						
util living area	0.9949	0.9898	0.9761	0.9223	0.7946	0.5872	0.4273	0.4701	0.7301	0.9435	0.9883	0.9957 (86)						
MIT	19.9819	20.1390	20.3785	20.7054	20.9100	20.9886	20.9986	20.9976	20.9597	20.7016	20.3136	19.9888 (87)						
Th 2	19.5444	19.5528	19.5611	19.6002	19.6076	19.6422	19.6422	19.6486	19.6288	19.6076	19.5927	19.5772 (88)						
util rest of house	0.9920	0.9842	0.9624	0.8812	0.7077	0.4685	0.2963	0.3335	0.6070	0.9033	0.9806	0.9933 (89)						
MIT 2	18.6818	18.8428	19.0808	19.4086	19.5663	19.6395	19.6421	19.6484	19.6166	19.4205	19.0479	18.7149 (90)						
Living area fraction	fLA = Living area / (4) =												0.6882 (91)					
MIT	19.5765	19.7349	19.9739	20.3011	20.4911	20.5680	20.5757	20.5769	20.5410	20.3022	19.9190	19.5916 (92)						
Temperature adjustment													-0.1500					
adjusted MIT	19.4265	19.5849	19.8239	20.1511	20.3411	20.4180	20.4257	20.4269	20.3910	20.1522	19.7690	19.4416 (93)						
8. Space heating requirement																		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Utilisation	0.9917	0.9843	0.9654	0.8994	0.7562	0.5374	0.3722	0.4126	0.6786	0.9216	0.9818	0.9930 (94)						
Useful gains	253.8443	279.1749	295.8383	300.9206	265.2601	184.6488	122.5857	128.1776	196.2937	242.9932	244.6371	245.5938 (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	527.1475	508.2196	457.9740	374.2522	285.6400	186.7020	122.7673	128.5062	204.2198	315.7579	424.1059	516.9125 (97)						
Space heating kWh	203.3376	153.9181	120.6289	52.7988	15.1626	0.0000	0.0000	0.0000	0.0000	54.1369	129.2176	201.8611 (98a)						
Space heating requirement - total per year (kWh/year)												931.0615						
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	203.3376	153.9181	120.6289	52.7988	15.1626	0.0000	0.0000	0.0000	0.0000	54.1369	129.2176	201.8611 (98c)						
Space heating requirement after solar contribution - total per year (kWh/year)												931.0615						
Space heating per m2	(98c) / (4) =											45.2851 (99)						
9a. Energy requirements - Individual heating systems, including micro-CHP																		
Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)					
Fraction of space heat from main system(s)													0.9000 (202)					
Efficiency of main space heating system 1 (in %)													79.0000 (206)					
Efficiency of main space heating system 2 (in %)													0.0000 (207)					
Efficiency of secondary/supplementary heating system, %													100.0000 (208)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Space heating requirement	203.3376	153.9181	120.6289	52.7988	15.1626	0.0000	0.0000	0.0000	0.0000	54.1369	129.2176	201.8611 (98)						
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000 (210)						
Space heating fuel (main heating system)	231.6504	175.3497	137.4254	60.1505	17.2739	0.0000	0.0000	0.0000	0.0000	61.6750	147.2099	229.9683 (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)	20.3338	15.3918	12.0629	5.2799	1.5163	0.0000	0.0000	0.0000	0.0000	5.4137	12.9218	20.1861 (215)						
Water heating																		
Water heating requirement	175.3542	155.4261	165.8324	147.3173	143.8776	130.7986	129.8400	134.2889	134.9989	149.1750	156.9885	173.6208 (64)						
Efficiency of water heater	79.3411	78.9882	78.3201	77.0124	75.7027	75.0000	75.0000	75.0000	75.0000	77.0320	78.5830	79.3471 (217)						
Fuel for water heating, kWh/month	156.7853	138.5001	146.6719	127.2551	122.7416	108.6447	105.1748	111.1067	114.2451	127.5004	137.0189	154.5890 (219)						
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)						
Pumps and Fa	55.4858	50.1162	55.4858	53.6959	55.4858	53.6959	55.4858	55.4858	53.6959	55.4858	53.6959	55.4858 (231)						
Lighting	8.2403	6.6107	5.9522	4.3608	3.3684	2.7520	3.0728	3.9941	5.1880	6.8069	7.6884	8.4693 (232)						
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)						
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)						
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)						

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

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

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

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	20.5600 (1b)	x 2.4000 (2b)	= 49.3440 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	20.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	49.3440 (5)

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2. Ventilation rate

	m3 per hour											
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												2 * 10 = 20.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											20.0000 / (5) = 0.4053 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.6553 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.5570 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.7102	0.6963	0.6823	0.6127	0.5988	0.5292	0.5292	0.5152	0.5570	0.5988	0.6266	0.6545 (22b)
	0.7522	0.7424	0.7328	0.6877	0.6793	0.6400	0.6400	0.6327	0.6551	0.6793	0.6963	0.7142 (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)			3.6700	1.1450	4.2023		(27)					
External Wall 1	23.9600	3.6700	20.2900	0.1800	3.6522		(29a)					
External Roof 1	20.5600		20.5600	0.1100	2.2616		(30)					
Total net area of external elements Aum(A, m2)			44.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1161		(33)					
Party Wall 1			23.9600	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							432.4528 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)							2.2260 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	12.3421 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 12.2483	Feb 12.0889	Mar 11.9326	Apr 11.1984	May 11.0610	Jun 10.4216	Jul 10.4216	Aug 10.3032	Sep 10.6679	Oct 11.0610	Nov 11.3389	Dec 11.6294 (38)
Heat transfer coeff	24.5904	24.4310	24.2747	23.5405	23.4031	22.7637	22.7637	22.6453	23.0100	23.4031	23.6810	23.9715 (39)
Average = Sum(39)m / 12 =												23.5398
HLP	Jan 1.1960	Feb 1.1883	Mar 1.1807	Apr 1.1450	May 1.1383	Jun 1.1072	Jul 1.1072	Aug 1.1014	Sep 1.1192	Oct 1.1383	Nov 1.1518	Dec 1.1659 (40)
HLP (average)												1.1449
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.0357 (42)											
Hot water usage for mixer showers	53.3080 52.5068 51.3395 49.1059 47.4576 45.6194 44.5745 45.7331 47.0031 48.9767 51.2583 53.1037 (42a)											
Hot water usage for baths	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)											
Hot water usage for other uses	25.2365 24.3188 23.4011 22.4835 21.5658 20.6481 20.6481 21.5658 22.4835 23.4011 24.3188 25.2365 (42c)											
Average daily hot water use (litres/day)	72.0905 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.5445	76.8257	74.7406	71.5893	69.0233	66.2674	65.2226	67.2989	69.4865	72.3779	75.5771	78.3402 (44)
Energy content (annual)	124.3953	109.3988	114.8735	98.0022	92.9187	81.4836	78.8811	83.3300	85.6838	98.2161	107.6735	122.6619 (45)
Distribution loss (46)m = 0.15 x (45)m	18.6593 16.4098 17.2310 14.7003 13.9378 12.2225 11.8322 12.4995 12.8526 14.7324 16.1510 18.3993 (46)											
Water storage loss:												
Total storage loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)											
If cylinder contains dedicated solar storage												
Primary loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)											
	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)											

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Combi loss	40.0254	35.3609	38.0870	35.3043	35.1735	32.6798	33.2367	34.2948	34.2673	36.8830	37.2709	39.9213 (61)
Total heat required for water heating calculated for each month												
WWHRS	164.4207	144.7596	152.9605	133.3066	128.0922	114.1634	112.1178	117.6248	119.9512	135.0991	144.9444	162.5832 (62)
PV diverter	-24.3702	-21.5532	-22.5692	-18.6882	-17.4168	-14.9036	-13.9698	-14.8555	-15.4199	-18.1783	-20.5939	-23.9189 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	140.0505	123.2064	130.3913	114.6183	110.6754	99.2598	98.1480	102.7693	104.5313	116.9207	124.3505	138.6644 (64)
												1403.5860 (64)
12Total per year (kWh/year)												1404 (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)
												0.0000 (64a)
Heat gains from water heating, kWh/month	51.3678	45.2153	47.7172	41.4118	39.6888	35.2632	34.5371	36.2809	37.0567	41.8776	45.1192	50.7654 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.6588	43.9080	39.6588	40.9808	39.6588	40.9808	39.6588	39.6588	40.9808	39.6588	40.9808	39.6588 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	76.8802	77.6780	75.6676	71.3878	65.9852	60.9076	57.5155	56.7177	58.7281	63.0079	68.4104	73.4880 (68)
Pumps, fans	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277 (71)
Total internal gains	69.0427	67.2847	64.1360	57.5164	53.3452	48.9767	46.4209	48.7647	51.4677	56.2871	62.6655	68.2331 (72)
	227.1171	230.4060	220.9978	211.4204	200.5247	189.4005	182.1306	183.6766	189.7119	200.4892	213.5921	222.9153 (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	
West			3.6700		19.6403		0.6300		0.7000		0.7700		22.0285 (80)	
Solar gains	22.0285	43.0924	70.9671	103.5013	126.8447	129.8482	123.6208	106.1884	82.5377	51.1328	27.4670	18.1152	(83)	
Total gains	249.1456	273.4985	291.9650	314.9217	327.3694	319.2487	305.7513	289.8650	272.2496	251.6220	241.0591	241.0305	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	100.4369	101.0924	101.7434	104.9165	105.5323	108.4967	108.4967	109.0640	107.3353	105.5323	104.2939	103.0300
util living area	7.6958	7.7395	7.7829	7.9944	8.0355	8.2331	8.2331	8.2709	8.1557	8.0355	7.9529	7.8687
	0.9915	0.9809	0.9506	0.8394	0.6562	0.4560	0.3276	0.3593	0.5802	0.8740	0.9761	0.9929 (86)
MIT	20.4618	20.5883	20.7548	20.9322	20.9907	20.9996	21.0000	21.0000	20.9973	20.9223	20.6897	20.4607 (87)
Th 2	19.9232	19.9294	19.9355	19.9643	19.9697	19.9950	19.9950	19.9997	19.9852	19.9697	19.9588	19.9474 (88)
util rest of house	0.9872	0.9717	0.9288	0.7888	0.5876	0.3846	0.2528	0.2812	0.4966	0.8194	0.9629	0.9892 (89)
MIT 2	19.3398	19.5010	19.7031	19.9131	19.9647	19.9948	19.9950	19.9997	19.9842	19.9140	19.6517	19.3585 (90)
Living area fraction												0.6882 (91)
MIT	20.1120	20.2493	20.4269	20.6144	20.6708	20.6863	20.6866	20.6881	20.6814	20.6079	20.3661	20.1171 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1120	20.2493	20.4269	20.6144	20.6708	20.6863	20.6866	20.6881	20.6814	20.6079	20.3661	20.1171 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9881	0.9749	0.9398	0.8216	0.6347	0.4337	0.3042	0.3350	0.5542	0.8549	0.9688	0.9899 (94)
Ext temp.	246.1713	266.6287	274.3986	258.7473	207.7854	138.4664	93.0236	97.0975	150.8742	215.1128	233.5307	238.5981 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	388.8243	374.9992	338.0710	275.7640	209.9453	138.5476	93.0272	97.1051	151.4390	234.2164	314.1539	381.5560 (97)
Space heating requirement - total per year (kWh/year)	106.1338	72.8249	47.3722	12.2520	1.6070	0.0000	0.0000	0.0000	0.0000	14.2131	58.0488	106.3606 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)

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Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh												
106.1338	72.8249	47.3722	12.2520	1.6070	0.0000	0.0000	0.0000	0.0000	14.2131	58.0488	106.3606 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												418.8124
Space heating per m2												(98c) / (4) = 20.3703 (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	106.1338	72.8249	47.3722	12.2520	1.6070	0.0000	0.0000	0.0000	0.0000	14.2131	58.0488	106.3606 (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)	114.8634	78.8149	51.2687	13.2597	1.7392	0.0000	0.0000	0.0000	0.0000	15.3822	62.8233	115.1089 (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	140.0505	123.2064	130.3913	114.6183	110.6754	99.2598	98.1480	102.7693	104.5313	116.9207	124.3505	138.6644 (64)
Efficiency of water heater (217)m	83.7947	83.2934	82.4249	81.0572	80.4113	80.3000	80.3000	80.3000	80.3000	81.1509	82.8507	80.3000 (216)
Fuel for water heating, kWh/month	167.1353	147.9186	158.1941	141.4042	137.6366	123.6111	122.2267	127.9817	130.1759	144.0782	150.0899	83.8198 (217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	8.2403	6.6107	5.9522	4.3608	3.3684	2.7520	3.0728	3.9941	5.1880	6.8069	7.6884	8.4693 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-10.4674	-15.2207	-22.5860	-26.2923	-29.2007	-27.6481	-27.3870	-25.4733	-22.1748	-17.8773	-11.6995	-9.0023 (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	-4.5845	-9.7705	-19.6277	-29.7546	-39.5657	-39.7612	-39.2160	-33.0383	-24.0501	-13.9771	-6.1297	-3.6100 (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												453.2602 (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												1715.8841 (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)												66.5041 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-508.1148 (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												1813.5336 (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	453.2602	0.2100	95.1846 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1715.8841	0.2100	360.3357 (264)
Space and water heating			455.5203 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	66.5041	0.1443	9.5986 (268)

Energy saving/generation technologies

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PV Unit electricity used in dwelling	-245.0294	0.1338	-32.7928
PV Unit electricity exported	-263.0853	0.1257	-33.0628
Total			-65.8556 (269)
Total CO2, kg/year			411.1925 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			20.0000 (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	453.2602	1.1300	512.1840 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1715.8841	1.1300	1938.9490 (278)
Space and water heating			2451.1330 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	66.5041	1.5338	102.0062 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-245.0294	1.4946	-366.2155
PV Unit electricity exported	-263.0853	0.4613	-121.3616
Total			-487.5771 (283)
Total Primary energy kWh/year			2195.6629 (286)
Target Primary Energy Rate (TPER)			106.7900 (287)

Full SAP Calculation Printout



Property Reference	Studio Flat 5			Issued on Date	21/08/2023
Assessment Reference	Proposed	Prop Type Ref	New 05		
Property					
SAP Rating	78 C	DER	5.49	TER	20.94
Environmental	98 A	% DER < TER			73.78
CO ₂ Emissions (t/year)	0.1	DFEE	32.98	TFEE	33.24
Compliance Check	See BREL	% DFEE < TFEE			0.77
% DPER < TPER	48.42	DPER	57.69	TPER	111.84
Assessor Details				Assessor ID	V922-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	20.5600 (1b)	x 2.4000 (2b)	= 49.3440 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	20.5600		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 49.3440 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.4053 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.8000 (17)
Number of sides sheltered	0.6453 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.5485 (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	0.6994	0.6857	0.6719	0.6034	0.5897	0.5211	0.5211	0.5074	0.5485	0.5897	0.6171	0.6445 (22b)
Effective ac	0.7446	0.7351	0.7257	0.6820	0.6738	0.6358	0.6358	0.6287	0.6504	0.6738	0.6904	0.7077 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (Uw = 1.30)			3.6700	1.2357	4.5352		(27)
External Wall 1	23.9600	3.6700	20.2900	0.1800	3.6522	150.0000	3043.5000 (29a)
External Roof 1	20.5600		20.5600	0.1300	2.6728	9.0000	185.0400 (30)
Total net area of external elements A _{um} (A, m ²)			44.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	10.8602		(33)
Party Wall 1			23.9600	0.0000	0.0000	180.0000	4312.8000 (32)
Party Floor 1			20.5600			40.0000	822.4000 (32d)
Internal Wall 1			58.6100			9.0000	527.4900 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 8891.2300 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 432.4528 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	1.7400	0.0210	0.0365
E3 Sill	1.7400	0.0270	0.0470
E4 Jamb	4.2200	0.0210	0.0886
E7 Party floor between dwellings (in blocks of flats)	9.9800	0.0440	0.4391
E14 Flat roof	9.9800	0.0800	0.7984
E16 Corner (normal)	2.4000	0.0480	0.1152
E18 Party wall between dwellings	4.8000	0.0780	0.3744
P2 Party wall - Intermediate floor within a dwelling	9.9800	0.0000	0.0000
P5 Party wall - Roof (insulation at rafter level)	9.9800	0.0800	0.7984

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.6977 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 13.5578 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	12.1240	11.9693	11.8178	11.1058	10.9726	10.3526	10.3526	10.2377	10.5914	10.9726	11.2421	11.5238 (38)
Average = Sum(39)m / 12 =	25.6818	25.5272	25.3756	24.6637	24.5305	23.9104	23.9104	23.7956	24.1492	24.5305	24.7999	25.0816 (39)
HLP	1.2491	1.2416	1.2342	1.1996	1.1931	1.1630	1.1630	1.1574	1.1746	1.1931	1.2062	1.2199 (40)
HLP (average)												1.1996
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0357 (42)
Hot water usage for mixer showers	53.3080	52.5068	51.3395	49.1059	47.4576	45.6194	44.5745	45.7331	47.0031	48.9767	51.2583	53.1037 (42a)	
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)	
Hot water usage for other uses	25.2365	24.3188	23.4011	22.4835	21.5658	20.6481	20.6481	21.5658	22.4835	23.4011	24.3188	25.2365 (42c)	
Average daily hot water use (litres/day)												72.0905 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.5445	76.8257	74.7406	71.5893	69.0233	66.2674	65.2226	67.2989	69.4865	72.3779	75.5771	78.3402 (44)	
Energy content (annual)	124.3953	109.3988	114.8735	98.0022	92.9187	81.4836	78.8811	83.3300	85.6838	98.2161	107.6735	122.6619 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1197.5185	
	18.6593	16.4098	17.2310	14.7003	13.9378	12.2225	11.8322	12.4995	12.8526	14.7324	16.1510	18.3993 (46)	
Water storage loss:													
Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage													
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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													
	179.6721	159.3262	170.1503	151.4959	148.1955	134.9772	134.1579	138.6068	139.1775	153.4929	161.1672	177.9387 (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													
	179.6721	159.3262	170.1503	151.4959	148.1955	134.9772	134.1579	138.6068	139.1775	153.4929	161.1672	177.9387 (64)	
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				1848.3583 (64)	
												1848 (64)	

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.6588	43.9080	39.6588	40.9808	39.6588	40.9808	39.6588	39.6588	40.9808	39.6588	40.9808	39.6588 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	76.8802	77.6780	75.6676	71.3878	65.9852	60.9076	57.5155	56.7177	58.7281	63.0079	68.4104	73.4880 (68)
	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785 (69)

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Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277 (71)
Water heating gains (Table 5)	115.0307	113.5670	110.7754	104.6954	100.9636	97.0670	94.6901	96.6783	99.0067	103.3310	109.1616	114.2561 (72)
Total internal gains	270.1051	273.6884	264.6372	255.5993	245.1430	237.4908	230.3997	231.5902	237.2509	244.5332	257.0882	265.9383 (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
West					3.6700	19.6403	0.7200	0.7000		0.7700		25.1754 (80)
Solar gains	25.1754	49.2485	81.1053	118.2872	144.9654	148.3979	141.2809	121.3582	94.3288	58.4375	31.3908	20.7031 (83)
Total gains	295.2806	322.9369	345.7425	373.8866	390.1085	385.8887	371.6806	352.9484	331.5797	302.9707	288.4790	286.6414 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	96.1687	96.7513	97.3292	100.1387	100.6824	103.2934	103.2934	103.7918	102.2718	100.6824	99.5885	98.4699
alpha	7.4112	7.4501	7.4886	7.6759	7.7122	7.8862	7.8862	7.9195	7.8181	7.7122	7.6392	7.5647
util living area	0.9795	0.9591	0.9077	0.7649	0.5809	0.3964	0.2830	0.3101	0.5014	0.7966	0.9467	0.9820 (86)
MIT	20.5435	20.6687	20.8229	20.9591	20.9950	20.9998	21.0000	21.0000	20.9987	20.9547	20.7648	20.5412 (87)
Th 2	19.8809	19.8869	19.8927	19.9203	19.9255	19.9497	19.9497	19.9543	19.9404	19.9255	19.9150	19.9041 (88)
util rest of house	0.9701	0.9421	0.8745	0.7086	0.5157	0.3314	0.2155	0.2396	0.4251	0.7319	0.9223	0.9737 (89)
MIT 2	19.4040	19.5579	19.7351	19.8914	19.9230	19.9497	19.9497	19.9543	19.9400	19.8959	19.6969	19.4210 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.6882 (91)
MIT	20.1882	20.3224	20.4837	20.6262	20.6608	20.6724	20.6726	20.6740	20.6686	20.6245	20.4318	20.1919 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1882	20.3224	20.4837	20.6262	20.6608	20.6724	20.6726	20.6740	20.6686	20.6245	20.4318	20.1919 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9731	0.9494	0.8933	0.7462	0.5605	0.3762	0.2620	0.2881	0.4776	0.7752	0.9350	0.9762 (94)
Ext temp.	287.3331	306.6103	308.8628	278.9863	218.6536	145.1529	97.3745	101.6973	158.3678	234.8480	269.7324	279.8168 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	408.0387	393.6908	354.8455	289.2123	219.8114	145.1935	97.3764	101.7011	158.6277	245.9068	330.6283	401.1040 (97)
Space heating requirement - total per year (kWh/year)	89.8049	58.5181	34.2112	7.3627	0.8614	0.0000	0.0000	0.0000	0.0000	8.2278	43.8450	90.2377 (98a)
Solar heating kWh												333.0688
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	89.8049	58.5181	34.2112	7.3627	0.8614	0.0000	0.0000	0.0000	0.0000	8.2278	43.8450	90.2377 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												333.0688
Space heating per m2										(98c) / (4) =		16.1998 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (301)
Fraction of space heat from community system												0.9000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating:												
Space heating requirement	89.8049	58.5181	34.2112	7.3627	0.8614	0.0000	0.0000	0.0000	0.0000	8.2278	43.8450	90.2377 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	121.2367	78.9995	46.1851	9.9396	1.1629	0.0000	0.0000	0.0000	0.0000	11.1075	59.1908	121.8209
Space heating requirement	121.2367	78.9995	46.1851	9.9396	1.1629	0.0000	0.0000	0.0000	0.0000	11.1075	59.1908	121.8209 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												100.0000 (308)
Space heating fuel for secondary/supplementary system	8.9805	5.8518	3.4211	0.7363	0.0861	0.0000	0.0000	0.0000	0.0000	0.8228	4.3845	9.0238 (309)

Water heating
Annual water heating requirement

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	179.6721	159.3262	170.1503	151.4959	148.1955	134.9772	134.1579	138.6068	139.1775	153.4929	161.1672	177.9387 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	269.5081	238.9893	255.2255	227.2439	222.2932	202.4659	201.2369	207.9103	208.7663	230.2394	241.7507	266.9080
Water heating fuel												
	269.5081	238.9893	255.2255	227.2439	222.2932	202.4659	201.2369	207.9103	208.7663	230.2394	241.7507	266.9080 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
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 (331)
Lighting	8.2403	6.6107	5.9522	4.3608	3.3684	2.7520	3.0728	3.9941	5.1880	6.8069	7.6884	8.4693 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-14.1135	-19.4486	-27.1211	-29.7474	-31.8648	-29.7606	-29.4914	-27.9628	-25.3021	-21.7746	-15.3302	-12.2837 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												449.6428 (307)
Space heating fuel - secondary												33.3069 (309)
Water heating fuel - community heating												2772.5374 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												4.4964 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (331)
Electricity for lighting (calculated in Appendix L)												66.5041 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-284.2009 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3037.7903 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	920.6229	0.1587	20.3851 (367)
Electrical energy for heat distribution (space & water)	4.4964	0.0000	4.6112 (372)
Overall CO2 factor for heat network			0.0423 (386)
Total CO2 associated with community systems			136.3585 (373)
Space heating - secondary	33.3069	0.1587	5.2850 (374)
Space and water heating			141.6435 (376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (378)
Energy for lighting	66.5041	0.1443	9.5986 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-284.2009	0.1350	-38.3638
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-38.3638 (380)
Total CO2, kg/year			112.8783 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.4900 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	920.6229	1.5874	203.9280 (467)
Electrical energy for heat distribution (space & water)	4.4964	0.0000	49.2746 (472)
Overall CO2 factor for heat network			0.4522 (486)
Total CO2 associated with community systems			1457.1207 (473)
Space heating - secondary	33.3069	1.5874	52.8702 (374)
Space and water heating			1509.9910 (476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (478)
Energy for lighting	66.5041	1.5338	102.0062 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-284.2009	1.4989	-425.9925
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-425.9925 (480)
Total Primary energy kWh/year			1186.0046 (483)
Dwelling Primary energy Rate (DPER)			57.6900 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	20.5600 (1b)	x 2.4000 (2b)	= 49.3440 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	20.5600		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 49.3440 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.4053 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6553 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.5570 (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	0.7102	0.6963	0.6823	0.6127	0.5988	0.5292	0.5292	0.5152	0.5570	0.5988	0.6266	0.6545 (22b)
Effective ac	0.7522	0.7424	0.7328	0.6877	0.6793	0.6400	0.6400	0.6327	0.6551	0.6793	0.6963	0.7142 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			3.6700	1.1450	4.2023		(27)
External Wall 1	23.9600	3.6700	20.2900	0.1800	3.6522		(29a)
External Roof 1	20.5600		20.5600	0.1100	2.2616		(30)
Total net area of external elements Aum(A, m ²)			44.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		10.1161		(33)
Party Wall 1			23.9600	0.0000	0.0000		(32)

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

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	1.7400	0.0500	0.0870
E2 Other lintels (including other steel lintels)	1.7400	0.0500	0.0870
E3 Sill	4.2200	0.0500	0.2110
E4 Jamb	9.9800	0.0700	0.6986
E7 Party floor between dwellings (in blocks of flats)	9.9800	0.0800	0.7984
E14 Flat roof	2.4000	0.0900	0.2160
E16 Corner (normal)	4.8000	0.0600	0.2880
E18 Party wall between dwellings	9.9800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	9.9800	0.0000	0.0000
P5 Party wall - Roof (insulation at rafter level)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.1844 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 13.3005 (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	12.2483	12.0889	11.9326	11.1984	11.0610	10.4216	10.4216	10.3032	10.6679	11.0610	11.3389	11.6294 (38)
Heat transfer coeff	25.5488	25.3894	25.2331	24.4989	24.3615	23.7221	23.7221	23.6037	23.9684	24.3615	24.6394	24.9299 (39)
Average = Sum(39)m / 12 =												24.4982

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HLP	Jan 1.2426	Feb 1.2349	Mar 1.2273	Apr 1.1916	May 1.1849	Jun 1.1538	Jul 1.1538	Aug 1.1480	Sep 1.1658	Oct 1.1849	Nov 1.1984	Dec 1.2125 (40)
HLP (average)												1.1915
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0357 (42)
Hot water usage for mixer showers												
53.3080	52.5068	51.3395	49.1059	47.4576	45.6194	44.5745	45.7331	47.0031	48.9767	51.2583	53.1037 (42a)	
Hot water usage for baths												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)	
Hot water usage for other uses												
25.2365	24.3188	23.4011	22.4835	21.5658	20.6481	20.6481	21.5658	22.4835	23.4011	24.3188	25.2365 (42c)	
Average daily hot water use (litres/day)												72.0905 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
78.5445	76.8257	74.7406	71.5893	69.0233	66.2674	65.2226	67.2989	69.4865	72.3779	75.5771	78.3402 (44)	
Energy content (annual)	124.3953	109.3988	114.8735	98.0022	92.9187	81.4836	78.8811	83.3300	85.6838	98.2161	107.6735	122.6619 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1197.5185
18.6593	16.4098	17.2310	14.7003	13.9378	12.2225	11.8322	12.4995	12.8526	14.7324	16.1510	18.3993 (46)	
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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												
170.9902	151.4845	161.4684	143.0941	139.5136	126.5754	125.4760	129.9249	130.7757	144.8110	152.7653	169.2568 (62)	
WWHRS	-24.3702	-21.5532	-22.5692	-18.6882	-17.4168	-14.9036	-13.9698	-14.8555	-15.4199	-18.1783	-20.5939	-23.9189 (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												
146.6200	129.9313	138.8992	124.4058	122.0968	111.6718	111.5062	115.0695	115.3558	126.6327	132.1715	145.3379 (64)	
									Total per year (kWh/year) = Sum(64)m =			1519.6984 (64)
12Total per year (kWh/year)												1520 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =
												0.0000 (64a)
Heat gains from water heating, kWh/month												
78.6374	70.0437	75.4714	68.6592	68.1714	63.1668	63.5039	64.9832	64.5633	69.9328	71.8749	78.0610 (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	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847	51.7847 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	39.6588	43.9080	39.6588	40.9808	39.6588	40.9808	39.6588	39.6588	40.9808	39.6588	40.9808	39.6588 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	76.8802	77.6780	75.6676	71.3878	65.9852	60.9076	57.5155	56.7177	58.7281	63.0079	68.4104	73.4880 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785	28.1785 (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)												
	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277	-41.4277 (71)
Water heating gains (Table 5)												
	105.6954	104.2316	101.4400	95.3600	91.6282	87.7316	85.3547	87.3430	89.6713	93.9957	99.8263	104.9207 (72)
Total internal gains												
	263.7698	267.3530	258.3018	249.2640	238.8076	228.1554	221.0644	222.2549	227.9155	238.1978	250.7528	259.6030 (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
West			3.6700		19.6403		0.6300		0.7000		0.7700		22.0285 (80)
Solar gains	22.0285	43.0924	70.9671	103.5013	126.8447	129.8482	123.6208	106.1884	82.5377	51.1328	27.4670	18.1152	(83)
Total gains	285.7983	310.4454	329.2690	352.7653	365.6524	358.0036	344.6851	328.4433	310.4532	289.3306	278.2198	277.7181	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	96.6692	97.2764	97.8790	100.8121	101.3805	104.1133	104.1133	104.6356	103.0434	101.3805	100.2372	99.0691
alpha	7.4446	7.4851	7.5253	7.7208	7.7587	7.9409	7.9409	7.9757	7.8696	7.7587	7.6825	7.6046
util living area	0.9827	0.9660	0.9237	0.7955	0.6138	0.4238	0.3028	0.3305	0.5310	0.8191	0.9545	0.9847 (86)
MIT	20.5230	20.6435	20.7977	20.9479	20.9930	20.9997	21.0000	21.0000	20.9982	20.9461	20.7471	20.5229 (87)
Th 2	19.8860	19.8922	19.8982	19.9267	19.9321	19.9571	19.9571	19.9618	19.9475	19.9321	19.9213	19.9100 (88)
util rest of house	0.9746	0.9513	0.8940	0.7405	0.5461	0.3549	0.2310	0.2560	0.4510	0.7563	0.9327	0.9775 (89)
MIT 2	19.3837	19.5337	19.7144	19.8890	19.9285	19.9570	19.9571	19.9618	19.9469	19.8960	19.6833	19.4038 (90)
Living area fraction	fLA = Living area / (4) =											0.6882 (91)
MIT	20.1678	20.2975	20.4599	20.6178	20.6611	20.6746	20.6749	20.6763	20.6704	20.6187	20.4154	20.1740 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1678	20.2975	20.4599	20.6178	20.6611	20.6746	20.6749	20.6763	20.6704	20.6187	20.4154	20.1740 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9769	0.9573	0.9102	0.7768	0.5926	0.4023	0.2804	0.3073	0.5061	0.7981	0.9437	0.9796 (94)
Useful gains	279.2078	297.1886	299.7094	274.0178	216.6799	144.0401	96.6612	100.9306	157.1099	230.9028	262.5612	272.0408 (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	405.4035	390.9334	352.2522	287.0729	218.3059	144.1027	96.6641	100.9363	157.4825	244.0720	328.0839	398.2305 (97)
Space heating kWh	93.8896	62.9966	39.0919	9.3997	1.2098	0.0000	0.0000	0.0000	0.0000	9.7978	47.1763	93.8851 (98a)
Space heating requirement - total per year (kWh/year)												357.4468
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	93.8896	62.9966	39.0919	9.3997	1.2098	0.0000	0.0000	0.0000	0.0000	9.7978	47.1763	93.8851 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												357.4468
Space heating per m2												(98c) / (4) = 17.3855 (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	93.8896	62.9966	39.0919	9.3997	1.2098	0.0000	0.0000	0.0000	0.0000	9.7978	47.1763	93.8851 (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)	101.7222	68.2520	42.3530	10.1838	1.3107	0.0000	0.0000	0.0000	0.0000	10.6152	51.1120	101.7174 (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	146.6200	129.9313	138.8992	124.4058	122.0968	111.6718	111.5062	115.0695	115.3558	126.6327	132.1715	145.3379 (64)
Efficiency of water heater	83.0874	82.5313	81.6168	80.3722	79.8794	79.8000	79.8000	79.8000	79.8000	80.3851	81.9857	79.8000 (216)
(217)m	83.0874	82.5313	81.6168	80.3722	79.8794	79.8000	79.8000	79.8000	79.8000	80.3851	81.9857	83.1056 (217)
Fuel for water heating, kWh/month	176.4648	157.4327	170.1846	154.7871	152.8514	139.9395	139.7321	144.1973	144.5561	157.5325	161.2128	174.8834 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041 (231)
Lighting	8.2403	6.6107	5.9522	4.3608	3.3684	2.7520	3.0728	3.9941	5.1880	6.8069	7.6884	8.4693 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-10.4674	-15.2207	-22.5860	-26.2923	-29.2007	-27.6481	-27.3870	-25.4733	-22.1748	-17.8773	-11.6995	-9.0023 (233a)
(233a)m	-10.4674	-15.2207	-22.5860	-26.2923	-29.2007	-27.6481	-27.3870	-25.4733	-22.1748	-17.8773	-11.6995	-9.0023 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
(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)	-4.5845	-9.7705	-19.6277	-29.7546	-39.5657	-39.7612	-39.2160	-33.0383	-24.0501	-13.9771	-6.1297	-3.6100 (233b)
(233b)m	-4.5845	-9.7705	-19.6277	-29.7546	-39.5657	-39.7612	-39.2160	-33.0383	-24.0501	-13.9771	-6.1297	-3.6100 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year													
Space heating fuel - main system 1													387.2663 (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													1873.7745 (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)													66.5041 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-508.1148 (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													1905.4301 (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	387.2663	0.2100	81.3259	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1873.7745	0.2100	393.4926	(264)
Space and water heating			474.8186	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	66.5041	0.1443	9.5986	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-245.0294	0.1338	-32.7928	
PV Unit electricity exported	-263.0853	0.1257	-33.0628	
Total			-65.8556	(269)
Total CO2, kg/year			430.4908	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			20.9400	(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	387.2663	1.1300	437.6109	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1873.7745	1.1300	2117.3651	(278)
Space and water heating			2554.9760	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	66.5041	1.5338	102.0062	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-245.0294	1.4946	-366.2155	
PV Unit electricity exported	-263.0853	0.4613	-121.3616	
Total			-487.5771	(283)
Total Primary energy kWh/year			2299.5059	(286)
Target Primary Energy Rate (TPER)			111.8400	(287)

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Property Reference	Studio Flat 6			Issued on Date	21/08/2023
Assessment Reference	Baseline	Prop Type Ref	New 06		
Property					
SAP Rating	71 C	DER	32.37	TER	18.89
Environmental	84 B	% DER < TER			-71.36
CO ₂ Emissions (t/year)	0.8	DFEE	71.71	TFEE	40.20
Compliance Check	See BREL	% DFEE < TFEE			-78.35
% DPER < TPER	-98.85	DPER	199.78	TPER	100.47
Assessor Details				Assessor ID	V922-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	26.8800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 64.5120 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.3100 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	8.0000 (17)
Number of sides sheltered	0.7100 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.6035 (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	0.7695	0.7544	0.7393	0.6639	0.6488	0.5733	0.5733	0.5583	0.6035	0.6488	0.6790	0.7091 (22b)
Effective ac	0.7961	0.7846	0.7733	0.7204	0.7105	0.6644	0.6644	0.6558	0.6821	0.7105	0.7305	0.7514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			4.3900	1.3258	5.8201		(27)
External Wall 1	41.7600	4.3900	37.3700	0.1800	6.7266	150.0000	5605.5000 (29a)
External Roof 1	26.8800		26.8800	0.1500	4.0320	9.0000	241.9200 (30)
Total net area of external elements A _{um} (A, m ²)			68.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.5787		(33)
Party Wall 1			15.9300	0.0000	0.0000	180.0000	2867.4000 (32)
Party Floor 1			26.8800			40.0000	1075.2000 (32d)
Internal Wall 1			29.0400			9.0000	261.3600 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
 Thermal bridges (Default value $0.200 \times \text{total exposed area}$)
 Point Thermal bridges
 Total fabric heat loss

$(28) \dots (30) + (32) + (32a) \dots (32e) = 10051.3800 \text{ (34)}$
 373.9353 (35)
 13.7280 (36)
 $(36a) = 0.0000$
 $(33) + (36) + (36a) = 30.3067 \text{ (37)}$

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	16.9471	16.7024	16.4625	15.3357	15.1249	14.1435	14.1435	13.9618	14.5215	15.1249	15.5514	15.9973 (38)
Heat transfer coeff	47.2538	47.0091	46.7692	45.6424	45.4316	44.4502	44.4502	44.2685	44.8282	45.4316	45.8581	46.3039 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$												45.6414
HLP	1.7580	1.7488	1.7399	1.6980	1.6902	1.6537	1.6537	1.6469	1.6677	1.6902	1.7060	Dec 1.7226 (40)
HLP (average)												1.6980
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.1174 (42)											
Hot water usage for mixer showers	55.0732	54.2456	53.0395	50.7320	49.0291	47.1300	46.0506	47.2475	48.5596	50.5986	52.9557	54.8622 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	26.0731	25.1250	24.1768	23.2287	22.2806	21.3325	21.3325	22.2806	23.2287	24.1768	25.1250	26.0731 (42c)
Average daily hot water use (litres/day)												74.4785 (43)
Daily hot water use	81.1463	79.3705	77.2164	73.9607	71.3097	68.4625	67.3831	69.5281	71.7883	74.7754	78.0806	80.9353 (44)
Energy content (annual)	128.5159	113.0226	118.6787	101.2485	95.9966	84.1827	81.4940	86.0904	88.5221	101.4695	111.2402	126.7251 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	19.2774	16.9534	17.8018	15.1873	14.3995	12.6274	12.2241	12.9136	13.2783	15.2204	16.6860	19.0088 (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	179.4748	159.0500	169.6376	150.5636	146.9555	133.4978	132.4529	137.0493	137.8372	152.4284	160.5552	177.6840 (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	179.4748	159.0500	169.6376	150.5636	146.9555	133.4978	132.4529	137.0493	137.8372	152.4284	160.5552	177.6840 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = $\text{Sum}(64)\text{m} = 1837.1863 \text{ (64)}$											
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	55.4713	49.0869	52.2004	45.9939	44.6586	40.3195	39.8365	41.3648	41.7624	46.4783	49.3161	54.8758 (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	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3867	52.4638	47.3867	48.9662	47.3867	48.9662	47.3867	47.3867	48.9662	47.3867	48.9662	47.3867 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	90.4128	91.3510	88.9868	83.9536	77.6001	71.6287	67.6394	66.7012	69.0655	74.0987	80.4522	86.4235 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869 (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)	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951 (71)
Water heating gains (Table 5)	74.5581	73.0459	70.1618	63.8804	60.0250	55.9993	53.5437	55.5978	58.0033	62.4709	68.4946	73.7578 (72)
Total internal gains	255.1183	259.6214	249.2959	239.5609	227.7724	216.3549	208.3304	209.4464	215.7957	226.7169	240.6736	250.3287 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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North	4.3900				10.6334				0.7200				0.7000				0.7700				16.3042 (74)			
Solar gains	16.3042	31.1582	52.9454	85.0439	114.5619	122.6419	114.5019	90.8427	63.6575	37.0898	20.1134	13.5920 (83)												
Total gains	271.4225	290.7796	302.2413	324.6048	342.3343	338.9968	322.8324	300.2890	279.4532	263.8067	260.7870	263.9207 (84)												

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.0862	59.3939	59.6985	61.1723	61.4561	62.8130	62.8130	63.0708	62.2833	61.4561	60.8846	60.2983
alpha	4.9391	4.9596	4.9799	5.0782	5.0971	5.1875	5.1875	5.2047	5.1522	5.0971	5.0590	5.0199
util living area	0.9966	0.9946	0.9900	0.9711	0.9102	0.7571	0.5873	0.6464	0.8768	0.9767	0.9935	0.9971 (86)
MIT	19.6236	19.7575	19.9921	20.3663	20.7032	20.9252	20.9839	20.9743	20.8275	20.4251	19.9896	19.6280 (87)
Th 2	19.4996	19.5060	19.5124	19.5423	19.5479	19.5742	19.5742	19.5791	19.5641	19.5479	19.5365	19.5247 (88)
util rest of house	0.9949	0.9918	0.9843	0.9531	0.8525	0.6256	0.4072	0.4638	0.7777	0.9583	0.9895	0.9956 (89)
MIT 2	18.3101	18.4480	18.6850	19.0708	19.3748	19.5500	19.5722	19.5752	19.4900	19.1365	18.7025	18.3337 (90)
Living area fraction	19.2517	19.3868	19.6221	19.9995	20.3271	20.5359	20.5842	20.5782	fLA = Living area / (4) =			0.7169 (91)
MIT	19.2517	19.3868	19.6221	19.9995	20.3271	20.5359	20.5842	20.5782	20.4488	20.0603	19.6252	19.2615 (92)
Temperature adjustment	19.2517	19.3868	19.6221	19.9995	20.3271	20.5359	20.5842	20.5782	20.4488	20.0603	19.6252	0.0000
adjusted MIT	19.2517	19.3868	19.6221	19.9995	20.3271	20.5359	20.5842	20.5782	20.4488	20.0603	19.6252	19.2615 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9945	0.9915	0.9849	0.9598	0.8870	0.7186	0.5373	0.5960	0.8450	0.9662	0.9899	0.9953	(94)
Useful gains	269.9348	288.3167	297.6675	311.5699	303.6415	243.6198	173.4616	178.9639	236.1411	254.8865	258.1427	262.6683	(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													
	706.5243	681.0109	613.7076	506.6086	391.9416	263.8502	177.0990	184.9639	284.6070	429.7967	574.3816	697.4086	(97)
Space heating kWh													
	324.8225	263.8905	235.1338	140.4279	65.6953	0.0000	0.0000	0.0000	0.0000	130.1332	227.6920	323.4468	(98a)
Space heating requirement - total per year (kWh/year)												1711.2421	
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													
	324.8225	263.8905	235.1338	140.4279	65.6953	0.0000	0.0000	0.0000	0.0000	130.1332	227.6920	323.4468	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1711.2421	
Space heating per m2										(98c) / (4) =			63.6623 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)	
Fraction of space heat from main system(s)													0.9000 (202)	
Efficiency of main space heating system 1 (in %)													79.0000 (206)	
Efficiency of main space heating system 2 (in %)													0.0000 (207)	
Efficiency of secondary/supplementary heating system, %													100.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement														
	324.8225	263.8905	235.1338	140.4279	65.6953	0.0000	0.0000	0.0000	0.0000	130.1332	227.6920	323.4468 (98)		
Space heating efficiency (main heating system 1)														
	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000 (210)		
Space heating fuel (main heating system)														
	370.0510	300.6347	267.8740	159.9811	74.8427	0.0000	0.0000	0.0000	0.0000	148.2530	259.3959	368.4837 (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)														
	32.4823	26.3891	23.5134	14.0428	6.5695	0.0000	0.0000	0.0000	0.0000	13.0133	22.7692	32.3447 (215)		
Water heating														
Water heating requirement														
	179.4748	159.0500	169.6376	150.5636	146.9555	133.4978	132.4529	137.0493	137.8372	152.4284	160.5552	177.6840 (64)		
Efficiency of water heater														
(217)m	80.3330	80.1427	79.7423	78.8556	77.3786	75.0000	75.0000	75.0000	75.0000	78.6620	79.7936	80.3456 (217)		
Fuel for water heating, kWh/month														
	159.9789	141.0266	148.8278	128.3974	124.0609	112.2436	108.6587	114.7871	118.0295	128.9943	139.4099	157.7250 (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														
	55.4858	50.1162	55.4858	53.6959	55.4858	53.6959	55.4858	55.4858	53.6959	55.4858	53.6959	55.4858 (231)		
Lighting														
	9.8460	7.8988	7.1120	5.2106	4.0248	3.2883	3.6716	4.7724	6.1989	8.1333	9.1865	10.1197 (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)		

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

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

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

		Area (m ²)	Storey height (m)		Volume (m ³)
Ground floor		26.8800 (1b)	x	2.4000 (2b)	= 64.5120 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	26.8800				(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)			= 64.5120 (5)

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2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.3100	(8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000 (17)		
Infiltration rate	0.5600 (18)		
Number of sides sheltered	2 (19)		
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)		
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4760 (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	0.6069	0.5950	0.5831	0.5236	0.5117	0.4522	0.4522	0.4403	0.4760	0.5117	0.5355	0.5593 (22b)
Effective ac	0.6842	0.6770	0.6700	0.6371	0.6309	0.6022	0.6022	0.5969	0.6133	0.6309	0.6434	0.6564 (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)			4.3900	1.1450	5.0267			(27)				
External Wall 1	41.7600	4.3900	37.3700	0.1800	6.7266			(29a)				
External Roof 1	26.8800		26.8800	0.1100	2.9568			(30)				
Total net area of external elements Aum(A, m2)			68.6400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.7101			(33)				
Party Wall 1			15.9300	0.0000	0.0000			(32)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								373.9353 (35)				
Thermal bridges (User defined value 0.050 * total exposed area)								3.4320 (36)				
Point Thermal bridges						(36a) =		0.0000				
Total fabric heat loss						(33) + (36) + (36a) =		18.1421 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 14.5654	Feb 14.4132	Mar 14.2639	Apr 13.5629	May 13.4318	Jun 12.8213	Jul 12.8213	Aug 12.7082	Sep 13.0564	Oct 13.4318	Nov 13.6971	Dec 13.9745 (38)
Heat transfer coeff	32.7075	32.5553	32.4060	31.7051	31.5739	30.9634	30.9634	30.8503	31.1986	31.5739	31.8392	32.1166 (39)
Average = Sum(39)m / 12 =												31.7044
HLP	Jan 1.2168	Feb 1.2111	Mar 1.2056	Apr 1.1795	May 1.1746	Jun 1.1519	Jul 1.1519	Aug 1.1477	Sep 1.1607	Oct 1.1746	Nov 1.1845	Dec 1.1948 (40)
HLP (average)												1.1795
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.1174 (42)											
Hot water usage for mixer showers	55.0732 54.2456 53.0395 50.7320 49.0291 47.1300 46.0506 47.2475 48.5596 50.5986 52.9557 54.8622 (42a)											
Hot water usage for baths	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)											
Hot water usage for other uses	26.0731 25.1250 24.1768 23.2287 22.2806 21.3325 21.3325 22.2806 23.2287 24.1768 25.1250 26.0731 (42c)											
Average daily hot water use (litres/day)	74.4785 (43)											
Daily hot water use	Jan 81.1463	Feb 79.3705	Mar 77.2164	Apr 73.9607	May 71.3097	Jun 68.4625	Jul 67.3831	Aug 69.5281	Sep 71.7883	Oct 74.7754	Nov 78.0806	Dec 80.9353 (44)
Energy conte	128.5159	113.0226	118.6787	101.2485	95.9966	84.1827	81.4940	86.0904	88.5221	101.4695	111.2402	126.7251 (45)
Energy content (annual)	Total = Sum(45)m = 1237.1863											
Distribution loss (46)m = 0.15 x (45)m	19.2774	16.9534	17.8018	15.1873	14.3995	12.6274	12.2241	12.9136	13.2783	15.2204	16.6860	19.0088 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	41.3513	36.5322	39.3486	36.4738	36.3387	33.7624	34.3377	35.4308	35.4024	38.1047	38.5055	41.2437 (61)
Total heat required for water heating calculated for each month												

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WVHRS	169.8671	149.5548	158.0273	137.7223	132.3352	117.9450	115.8317	121.5211	123.9246	139.5743	149.7457	167.9688 (62)
PV diverter	-25.1772	-22.2669	-23.3166	-19.3071	-17.9935	-15.3972	-14.4324	-15.3474	-15.9305	-18.7803	-21.2758	-24.7109 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	144.6900	127.2879	134.7107	118.4153	114.3417	102.5479	101.3993	106.1737	107.9941	120.7940	128.4699	143.2579 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1450.0823 (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	53.0693	46.7131	49.2978	42.7836	41.0035	36.4313	35.6812	37.4827	38.2842	43.2648	46.6137	52.4470 (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	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3867	52.4638	47.3867	48.9662	47.3867	48.9662	47.3867	47.3867	48.9662	47.3867	48.9662	47.3867 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	90.4128	91.3510	88.9868	83.9536	77.6001	71.6287	67.6394	66.7012	69.0655	74.0987	80.4522	86.4235 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869 (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)	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951 (71)
Water heating gains (Table 5)	71.3298	69.5135	66.2605	59.4217	55.1123	50.5991	47.9586	50.3800	53.1725	58.1516	64.7413	70.4933 (72)
Total internal gains	251.8899	256.0889	245.3946	235.1021	222.8597	210.9546	202.7454	204.2286	210.9649	222.3976	236.9203	247.0642 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				4.3900	10.6334	0.6300	0.7000	0.7700	14.2662 (74)				
Solar gains	14.2662	27.2634		46.3272	74.4134	100.2417	107.3117	100.1892	79.4873	55.7003	32.4536	17.5992	11.8930 (83)
Total gains	266.1561	283.3524	291.7218	309.5155	323.1013	318.2663	302.9345	283.7159	266.6652	254.8512	254.5195		258.9572 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	85.3641	85.7634	86.1583	88.0632	88.4290	90.1726	90.1726	90.5031	89.4929	88.4290	87.6921	86.9348
alpha	6.6909	6.7176	6.7439	6.8709	6.8953	7.0115	7.0115	7.0335	6.9662	6.8953	6.8461	6.7957
util living area	0.9958	0.9926	0.9844	0.9458	0.8279	0.6140	0.4488	0.4983	0.7645	0.9549	0.9902	0.9964 (86)
MIT	20.2014	20.3096	20.4803	20.7406	20.9254	20.9921	20.9992	20.9984	20.9674	20.7572	20.4566	20.1981 (87)
Th 2	20.3916	20.3944	20.3972	20.4102	20.4127	20.4240	20.4240	20.4261	20.4197	20.4127	20.4078	20.4026 (88)
util rest of house	0.9948	0.9908	0.9805	0.9326	0.7934	0.5620	0.3905	0.4371	0.7135	0.9413	0.9876	0.9956 (89)
MIT 2	19.6487	19.7586	19.9298	20.1925	20.3591	20.4198	20.4238	20.4255	20.3999	20.2130	19.9162	19.6547 (90)
Living area fraction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (91)
MIT	20.0449	20.1536	20.3244	20.5854	20.7651	20.8301	20.8363	20.8362	20.8067	20.6031	20.3036	20.0443 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	20.0449	20.1536	20.3244	20.5854	20.7651	20.8301	20.8363	20.8362	20.8067	20.6031	20.3036	20.0443 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9941	0.9900	0.9799	0.9368	0.8147	0.5988	0.4323	0.4809	0.7482	0.9461	0.9870	0.9950 (94)
Ext temp.	264.5930	280.5073	285.8722	289.9582	263.2226	190.5922	130.9595	136.4383	199.5111	241.1179	251.2204	257.6600 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	514.9774	496.5856	447.9946	370.4871	286.2196	192.9044	131.1699	136.8597	209.2399	315.8381	420.3916	508.8640 (97)
Space heating requirement - total per year (kWh/year)	186.2860	145.2046	120.6190	57.9808	17.1097	0.0000	0.0000	0.0000	0.0000	55.5918	121.8032	186.8958 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)

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186.2860	145.2046	120.6190	57.9808	17.1097	0.0000	0.0000	0.0000	0.0000	55.5918	121.8032	186.8958 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											891.4910
Space heating per m2											(98c) / (4) = 33.1656 (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	186.2860	145.2046	120.6190	57.9808	17.1097	0.0000	0.0000	0.0000	0.0000	55.5918	121.8032	186.8958 (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)	201.6083	157.1479	130.5401	62.7498	18.5170	0.0000	0.0000	0.0000	0.0000	60.1643	131.8217	202.2682 (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	144.6900	127.2879	134.7107	118.4153	114.3417	102.5479	101.3993	106.1737	107.9941	120.7940	128.4699	143.2579 (64)
Efficiency of water heater	84.9239	84.6644	84.1454	82.9372	81.3240	80.3000	80.3000	80.3000	80.3000	82.8253	84.2674	80.3000 (216)
Fuel for water heating, kWh/month	170.3760	150.3441	160.0928	142.7770	140.6003	127.7059	126.2756	132.2213	134.4883	145.8419	152.4551	84.9522 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	9.8460	7.8988	7.1120	5.2106	4.0248	3.2883	3.6716	4.7724	6.1989	8.1333	9.1865	10.1197 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.3437	-19.2241	-28.2604	-32.5708	-35.8792	-33.8496	-33.5148	-31.3082	-27.4692	-22.4188	-14.8457	-11.4951 (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	-6.3351	-13.4492	-26.9295	-40.7045	-54.0256	-54.2809	-53.5614	-45.1893	-32.9649	-19.2274	-8.4640	-4.9942 (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												964.8171 (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												1751.8119 (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)												79.4629 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-664.3057 (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												2217.7863 (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	964.8171	0.2100	202.6116 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1751.8119	0.2100	367.8805 (264)
Space and water heating			570.4921 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	79.4629	0.1443	11.4690 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-304.1795	0.1340	-40.7726
PV Unit electricity exported	-360.1261	0.1257	-45.2846

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Total	-86.0572 (269)
Total CO2, kg/year	507.8331 (272)
EPC Target Carbon Dioxide Emission Rate (TER)	18.8900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	964.8171	1.1300	1090.2433 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1751.8119	1.1300	1979.5475 (278)
Space and water heating			3069.7908 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	79.4629	1.5338	121.8829 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-304.1795	1.4954	-454.8586
PV Unit electricity exported	-360.1261	0.4616	-166.2244
Total			-621.0831 (283)
Total Primary energy kWh/year			2700.6914 (286)
Target Primary Energy Rate (TPER)			100.4700 (287)

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Property Reference	Studio Flat 6				Issued on Date	21/08/2023	
Assessment Reference	Proposed			Prop Type Ref	New 06		
Property							
SAP Rating	77 C		DER	5.46		TER	19.25
Environmental	97 A		% DER < TER				71.64
CO ₂ Emissions (t/year)	0.13		DFEE	42.15		TFEE	42.46
Compliance Check	See BREL		% DFEE < TFEE				0.73
% DPER < TPER	44.40		DPER	56.93		TPER	102.40
Assessor Details	[REDACTED]				Assessor ID	V922-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	26.8800		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 64.5120 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.3100 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	5.0000 (17)
Number of sides sheltered	0.5600 (18)
	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4760 (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	0.6069	0.5950	0.5831	0.5236	0.5117	0.4522	0.4522	0.4403	0.4760	0.5117	0.5355	0.5593 (22b)
Effective ac	0.6842	0.6770	0.6700	0.6371	0.6309	0.6022	0.6022	0.5969	0.6133	0.6309	0.6434	0.6564 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.30)			4.3900	1.2357	5.4249		(27)
External Wall 1	41.7600	4.3900	37.3700	0.1800	6.7266	150.0000	5605.5000 (29a)
External Roof 1	26.8800		26.8800	0.1300	3.4944	9.0000	241.9200 (30)
Total net area of external elements A _{um} (A, m ²)			68.6400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6459		(33)
Party Wall 1			15.9300	0.0000	0.0000	180.0000	2867.4000 (32)
Party Floor 1			26.8800			40.0000	1075.2000 (32d)
Internal Wall 1			29.0400			9.0000	261.3600 (32c)

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Heat capacity Cm = Sum(A x k)												(28)...(30) + (32) + (32a)...(32e) = 10051.3800 (34)		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K														
List of Thermal Bridges														
K1 Element												Length	Psi-value	Total
E2 Other lintels (including other steel lintels)												1.9100	0.0210	0.0401
E3 Sill												1.9100	0.0270	0.0516
E4 Jamb												4.6000	0.0210	0.0966
E7 Party floor between dwellings (in blocks of flats)												17.3900	0.0440	0.7652
E14 Flat roof												17.3900	0.0800	1.3912
E16 Corner (normal)												9.6000	0.0480	0.4608
E17 Corner (inverted - internal area greater than external area)												4.8000	-0.0600	-0.2880
E18 Party wall between dwellings												7.2000	0.0780	0.5616
P2 Party wall - Intermediate floor within a dwelling												6.6300	0.0000	0.0000
P5 Party wall - Roof (insulation at rafter level)												6.6400	0.0800	0.5312
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												3.6102 (36)		
Point Thermal bridges												(36a) = 0.0000		
Total fabric heat loss												(33) + (36) + (36a) = 19.2561 (37)		
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)														
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)	
Heat transfer coeff	14.5654	14.4132	14.2639	13.5629	13.4318	12.8213	12.8213	12.7082	13.0564	13.4318	13.6971	13.9745	(38)	
Average = Sum(39)m / 12 =	33.8216	33.6693	33.5201	32.8191	32.6879	32.0774	32.0774	31.9644	32.3126	32.6879	32.9533	33.2306	(39)	
												32.8185		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)	
HLP (average)	1.2582	1.2526	1.2470	1.2209	1.2161	1.1934	1.1934	1.1892	1.2021	1.2161	1.2259	1.2363	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31		

4. Water heating energy requirements (kWh/year)														

Assumed occupancy												1.1174 (42)		
Hot water usage for mixer showers												54.8622 (42a)		
	55.0732	54.2456	53.0395	50.7320	49.0291	47.1300	46.0506	47.2475	48.5596	50.5986	52.9557	54.8622	(42a)	
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)	
Hot water usage for other uses	26.0731	25.1250	24.1768	23.2287	22.2806	21.3325	21.3325	22.2806	23.2287	24.1768	25.1250	26.0731	(42c)	
Average daily hot water use (litres/day)												74.4785	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	81.1463	79.3705	77.2164	73.9607	71.3097	68.4625	67.3831	69.5281	71.7883	74.7754	78.0806	80.9353	(44)	
Energy conte	128.5159	113.0226	118.6787	101.2485	95.9966	84.1827	81.4940	86.0904	88.5221	101.4695	111.2402	126.7251	(45)	
Energy content (annual)												Total = Sum(45)m = 1237.1863		
Distribution loss (46)m = 0.15 x (45)m	19.2774	16.9534	17.8018	15.1873	14.3995	12.6274	12.2241	12.9136	13.2783	15.2204	16.6860	19.0088	(46)	
Water storage loss:														
Store volume												110.0000	(47)	
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)		
Volume factor from Table 2a												1.0294 (52)		
Temperature factor from Table 2b												0.6000 (53)		
Enter (49) or (54) in (55)												1.0327 (55)		
Total storage loss														
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)	
If cylinder contains dedicated solar storage														
	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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														
	183.7927	162.9500	173.9555	154.7422	151.2734	137.6764	136.7708	141.3672	142.0158	156.7463	164.7339	182.0019	(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	183.7927	162.9500	173.9555	154.7422	151.2734	137.6764	136.7708	141.3672	142.0158	156.7463	164.7339	182.0019	(64)	
Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1888.0261 (64)		
Electric shower(s)												1888 (64)		
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)		
Heat gains from water heating, kWh/month														
	86.9530	77.5220	83.6821	76.4601	76.1403	70.7857	71.3182	72.8465	72.2286	77.9601	79.7823	86.3575	(65)	

5. Internal gains (see Table 5 and 5a)														
Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	47.3867	52.4638	47.3867	48.9662	47.3867	48.9662	47.3867	47.3867	48.9662	47.3867	48.9662	47.3867	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	90.4128	91.3510	88.9868	83.9536	77.6001	71.6287	67.6394	66.7012	69.0655	74.0987	80.4522	86.4235	(68)	

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Pumps, fans	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951 (71)
Total internal gains	116.8723	115.3601	112.4760	106.1946	102.3391	98.3135	95.8578	97.9119	100.3174	104.7850	110.8088	116.0720 (72)
	294.4324	298.9355	288.6100	278.8750	267.0865	258.6690	250.6446	251.7605	258.1098	266.0310	279.9878	289.6428 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.3900	10.6334		0.7200		0.7000		0.7700		16.3042 (74)
Solar gains	16.3042	31.1582	52.9454	85.0439	114.5619	122.6419	114.5019	90.8427	63.6575	37.0898	20.1134	13.5920	(83)
Total gains	310.7366	330.0937	341.5554	363.9189	381.6484	381.3110	365.1465	342.6032	321.7673	303.1208	300.1011	303.2348	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	82.5524	82.9257	83.2949	85.0740	85.4153	87.0410	87.0410	87.3489	86.4075	85.4153	84.7276	84.0204
util living area	6.5035	6.5284	6.5530	6.6716	6.6944	6.8027	6.8027	6.8233	6.7605	6.6944	6.6485	6.6014
	0.9907	0.9843	0.9683	0.9043	0.7538	0.5347	0.3862	0.4284	0.6740	0.9142	0.9784	0.9918 (86)
MIT	20.2740	20.3860	20.5606	20.8070	20.9536	20.9960	20.9996	20.9993	20.9827	20.8215	20.5335	20.2704 (87)
Th 2	19.8737	19.8782	19.8826	19.9033	19.9072	19.9253	19.9253	19.9287	19.9183	19.9072	19.8993	19.8911 (88)
util rest of house	0.9865	0.9774	0.9542	0.8663	0.6818	0.4469	0.2921	0.3291	0.5778	0.8716	0.9676	0.9881 (89)
MIT 2	19.0755	19.2190	19.4372	19.7362	19.8778	19.9239	19.9253	19.9285	19.9107	19.7613	19.4209	19.0848 (90)
Living area fraction	19.9347	20.0556	20.2426	20.5038	20.6490	20.6924	20.6955	20.6961	20.6792	20.5214	20.2185	0.7169 (91)
MIT	19.9347	20.0556	20.2426	20.5038	20.6490	20.6924	20.6955	20.6961	20.6792	20.5214	20.2185	19.9347 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9347	20.0556	20.2426	20.5038	20.6490	20.6924	20.6955	20.6961	20.6792	20.5214	20.2185	19.9347 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9868	0.9786	0.9593	0.8885	0.7318	0.5099	0.3596	0.4004	0.6465	0.8975	0.9712	0.9883 (94)
Ext temp.	306.6233	323.0429	327.6696	323.3520	279.3011	194.4145	131.2912	137.1620	208.0296	272.0443	291.4656	299.6863 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	528.7891	510.2797	460.6517	380.8265	292.5258	195.4298	131.3716	137.3229	212.5902	324.3085	432.2989	522.8749 (97)
Space heating requirement - total per year (kWh/year)	165.2914	125.8232	98.9387	41.3816	9.8391	0.0000	0.0000	0.0000	0.0000	38.8846	101.4000	166.0524 (98a)
Solar heating kWh												747.6109
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	165.2914	125.8232	98.9387	41.3816	9.8391	0.0000	0.0000	0.0000	0.0000	38.8846	101.4000	166.0524 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												747.6109
Space heating per m ²										(98c) / (4) =		27.8129 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (301)
Fraction of space heat from community system												0.9000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating:												
Space heating requirement	165.2914	125.8232	98.9387	41.3816	9.8391	0.0000	0.0000	0.0000	0.0000	38.8846	101.4000	166.0524 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50	223.1434	169.8613	133.5672	55.8652	13.2828	0.0000	0.0000	0.0000	0.0000	52.4942	136.8900	224.1707
Space heating requirement	223.1434	169.8613	133.5672	55.8652	13.2828	0.0000	0.0000	0.0000	0.0000	52.4942	136.8900	224.1707 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												100.0000 (308)
Space heating fuel for secondary/supplementary system	16.5291	12.5823	9.8939	4.1382	0.9839	0.0000	0.0000	0.0000	0.0000	3.8885	10.1400	16.6052 (309)

Water heating

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Annual water heating requirement	183.7927	162.9500	173.9555	154.7422	151.2734	137.6764	136.7708	141.3672	142.0158	156.7463	164.7339	182.0019 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	275.6890	244.4250	260.9333	232.1133	226.9101	206.5145	205.1563	212.0507	213.0237	235.1195	247.1008	273.0028
Water heating fuel												
	275.6890	244.4250	260.9333	232.1133	226.9101	206.5145	205.1563	212.0507	213.0237	235.1195	247.1008	273.0028 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
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 (331)
Lighting	9.8460	7.8988	7.1120	5.2106	4.0248	3.2883	3.6716	4.7724	6.1989	8.1333	9.1865	10.1197 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-14.6932	-20.5593	-29.0575	-32.0705	-34.3056	-31.9725	-31.6701	-29.9130	-26.8948	-23.0858	-16.0643	-12.7557 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												1009.2747 (307)
Space heating fuel - secondary												74.7611 (309)
Water heating fuel - community heating												2832.0391 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												10.0927 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (331)
Electricity for lighting (calculated in Appendix L)												79.4629 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-303.0424 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												3692.4955 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1097.5182	0.1566	45.1650 (367)
Electrical energy for heat distribution (space & water)	10.0927	0.0000	5.5627 (372)
Overall CO2 factor for heat network			0.0428 (386)
Total CO2 associated with community systems			164.4971 (373)
Space heating - secondary	74.7611	0.1566	11.7094 (374)
Space and water heating			176.2066 (376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (378)
Energy for lighting	79.4629	0.1443	11.4690 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-303.0424	0.1349	-40.8728
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-40.8728 (380)
Total CO2, kg/year			146.8028 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.4600 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1097.5182	1.5799	455.5769 (467)
Electrical energy for heat distribution (space & water)	10.0927	0.0000	58.9889 (472)
Overall CO2 factor for heat network			0.4541 (486)
Total CO2 associated with community systems			1744.3861 (473)
Space heating - secondary	74.7611	1.5799	118.1125 (374)
Space and water heating			1862.4986 (476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (478)
Energy for lighting	79.4629	1.5338	121.8829 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-303.0424	1.4985	-454.1063
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-454.1063 (480)
Total Primary energy kWh/year			1530.2752 (483)
Dwelling Primary energy Rate (DPER)			56.9300 (484)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	26.8800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 64.5120 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.3100 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.5600 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4760 (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	0.6069	0.5950	0.5831	0.5236	0.5117	0.4522	0.4522	0.4403	0.4760	0.5117	0.5355	0.5593 (22b)
Effective ac	0.6842	0.6770	0.6700	0.6371	0.6309	0.6022	0.6022	0.5969	0.6133	0.6309	0.6434	0.6564 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			4.3900	1.1450	5.0267		(27)
External Wall 1	41.7600	4.3900	37.3700	0.1800	6.7266		(29a)
External Roof 1	26.8800		26.8800	0.1100	2.9568		(30)
Total net area of external elements Aum(A, m ²)			68.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	14.7101		(33)
Party Wall 1			15.9300	0.0000	0.0000		(32)

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

373.9353 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	1.9100	0.0500	0.0955
E3 Sill	1.9100	0.0500	0.0955
E4 Jamb	4.6000	0.0500	0.2300
E7 Party floor between dwellings (in blocks of flats)	17.3900	0.0700	1.2173
E14 Flat roof	17.3900	0.0800	1.3912
E16 Corner (normal)	9.6000	0.0900	0.8640
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
E18 Party wall between dwellings	7.2000	0.0600	0.4320
P2 Party wall - Intermediate floor within a dwelling	6.6300	0.0000	0.0000
P5 Party wall - Roof (insulation at rafter level)	6.6400	0.0800	0.5312
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.4247 (36)
Point Thermal Bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 19.1348 (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	14.5654	14.4132	14.2639	13.5629	13.4318	12.8213	12.8213	12.7082	13.0564	13.4318	13.6971	13.9745 (38)
Heat transfer coeff	33.7002	33.5480	33.3987	32.6978	32.5666	31.9561	31.9561	31.8430	32.1913	32.5666	32.8319	33.1093 (39)
Average = Sum(39)m / 12 =												32.6971

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	Jan 1.2537	Feb 1.2481	Mar 1.2425	Apr 1.2164	May 1.2116	Jun 1.1888	Jul 1.1888	Aug 1.1846	Sep 1.1976	Oct 1.2116	Nov 1.2214	Dec 1.2317 (40)
HLP HLP (average)												1.2164
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.1174 (42)
Hot water usage for mixer showers												54.8622 (42a)
55.0732	54.2456	53.0395	50.7320	49.0291	47.1300	46.0506	47.2475	48.5596	50.5986	52.9557		
Hot water usage for baths												0.0000 (42b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Hot water usage for other uses												26.0731 (42c)
26.0731	25.1250	24.1768	23.2287	22.2806	21.3325	21.3325	22.2806	23.2287	24.1768	25.1250		
Average daily hot water use (litres/day)												74.4785 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	81.1463	79.3705	77.2164	73.9607	71.3097	68.4625	67.3831	69.5281	71.7883	74.7754	78.0806	80.9353 (44)
Energy content (annual)	128.5159	113.0226	118.6787	101.2485	95.9966	84.1827	81.4940	86.0904	88.5221	101.4695	111.2402	126.7251 (45)
Distribution loss (46)m = 0.15 x (45)m												1237.1863
19.2774	16.9534	17.8018	15.1873	14.3995	12.6274	12.2241	12.9136	13.2783	15.2204	16.6860		19.0088 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	175.1108	155.1083	165.2736	146.3404	142.5915	129.2745	128.0889	132.6853	133.6140	148.0644	156.3320	173.3200 (62)
WVHRS	-25.1772	-22.2669	-23.3166	-19.3071	-17.9935	-15.3972	-14.4324	-15.3474	-15.9305	-18.7803	-21.2758	-24.7109 (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	149.9336	132.8414	141.9570	127.0333	124.5980	113.8774	113.6565	117.3379	117.6835	129.2841	135.0562	148.6091 (64)
12Total per year (kWh/year)												1551.8679 (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	80.0075	71.2486	76.7366	69.7386	69.1948	64.0642	64.3727	65.9010	65.5071	71.0145	73.0608	79.4120 (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	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689	55.8689 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3867	52.4638	47.3867	48.9662	47.3867	48.9662	47.3867	47.3867	48.9662	47.3867	48.9662	47.3867 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	90.4128	91.3510	88.9868	83.9536	77.6001	71.6287	67.6394	66.7012	69.0655	74.0987	80.4522	86.4235 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869	28.5869 (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)	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951	-44.6951 (71)
Water heating gains (Table 5)	107.5369	106.0247	103.1406	96.8592	93.0037	88.9781	86.5224	88.5766	90.9821	95.4497	101.4734	106.7366 (72)
Total internal gains	288.0970	292.6001	282.2747	272.5396	260.7511	249.3336	241.3092	242.4251	248.7744	259.6956	273.6524	283.3074 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				4.3900	10.6334		0.6300		0.7000		0.7700		14.2662 (74)
Solar gains	14.2662	27.2634		46.3272	74.4134	100.2417	107.3117	100.1892	79.4873	55.7003	32.4536	17.5992	11.8930 (83)
Total gains	302.3632	319.8636	328.6019	346.9530	360.9928	356.6453	341.4984	321.9125	304.4748	292.1492	291.2516		295.2004 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	82.8496	83.2256	83.5975	85.3896	85.7335	87.3715	87.3715	87.6817	86.7332	85.7335	85.0407	84.3283
alpha	6.5233	6.5484	6.5732	6.6926	6.7156	6.8248	6.8248	6.8454	6.7822	6.7156	6.6694	6.6219
util living area	0.9919	0.9865	0.9735	0.9196	0.7830	0.5679	0.4112	0.4539	0.7041	0.9252	0.9813	0.9929 (86)
MIT	20.2569	20.3647	20.5346	20.7825	20.9425	20.9943	20.9994	20.9990	20.9780	20.8056	20.5159	20.2540 (87)
Th 2	20.3731	20.3760	20.3787	20.3918	20.3942	20.4056	20.4056	20.4077	20.4012	20.3942	20.3893	20.3841 (88)
util rest of house	0.9900	0.9835	0.9672	0.9020	0.7452	0.5173	0.3559	0.3960	0.6514	0.9053	0.9765	0.9912 (89)
MIT 2	19.6882	19.7972	19.9663	20.2134	20.3541	20.4026	20.4054	20.4073	20.3884	20.2394	19.9581	19.6946 (90)
Living area fraction									fLA = Living area / (4) =			0.7169 (91)
MIT	20.0959	20.2041	20.3737	20.6214	20.7759	20.8268	20.8313	20.8315	20.8110	20.6453	20.3579	20.0957 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0959	20.2041	20.3737	20.6214	20.7759	20.8268	20.8313	20.8315	20.8110	20.6453	20.3579	20.0957 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9891	0.9825	0.9672	0.9090	0.7695	0.5533	0.3955	0.4375	0.6879	0.9141	0.9762	0.9903 (94)
Useful gains	299.0536	314.2668	317.8204	315.3906	277.7815	197.3277	135.0679	140.8304	209.4594	267.0417	284.3250	292.3483 (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	532.3246	513.4202	463.3648	383.2626	295.5728	198.9847	135.2146	141.1108	216.0370	327.1402	435.2839	526.2945 (97)
Space heating kWh	173.5536	133.8311	108.2850	48.8678	13.2367	0.0000	0.0000	0.0000	0.0000	44.7133	108.6904	174.0559 (98a)
Space heating requirement - total per year (kWh/year)												805.2340
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	173.5536	133.8311	108.2850	48.8678	13.2367	0.0000	0.0000	0.0000	0.0000	44.7133	108.6904	174.0559 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												805.2340
Space heating per m2										(98c) / (4) =		29.9566 (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	173.5536	133.8311	108.2850	48.8678	13.2367	0.0000	0.0000	0.0000	0.0000	44.7133	108.6904	174.0559 (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)	188.0321	144.9958	117.3185	52.9446	14.3410	0.0000	0.0000	0.0000	0.0000	48.4435	117.7577	188.5763 (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	149.9336	132.8414	141.9570	127.0333	124.5980	113.8774	113.6565	117.3379	117.6835	129.2841	135.0562	148.6091 (64)
Efficiency of water heater (217)m	84.3887	84.0764	83.4603	82.1120	80.5843	79.8000	79.8000	79.8000	79.8000	81.9340	83.5772	79.8000 (216)
Fuel for water heating, kWh/month	177.6702	158.0007	170.0892	154.7073	154.6181	142.7035	142.4268	147.0399	147.4730	157.7906	161.5945	176.0455 (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	9.8460	7.8988	7.1120	5.2106	4.0248	3.2883	3.6716	4.7724	6.1989	8.1333	9.1865	10.1197 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-13.3437	-19.2241	-28.2604	-32.5708	-35.8792	-33.8496	-33.5148	-31.3082	-27.4692	-22.4188	-14.8457	-11.4951 (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	-6.3351	-13.4492	-26.9295	-40.7045	-54.0256	-54.2809	-53.5614	-45.1893	-32.9649	-19.2274	-8.4640	-4.9942 (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)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													872.4095	(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													1890.1594	(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)													79.4629	(232)

Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-664.3057	(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													2263.7262	(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	872.4095	0.2100	183.2060	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1890.1594	0.2100	396.9335	(264)
Space and water heating			580.1395	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	79.4629	0.1443	11.4690	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-304.1795	0.1340	-40.7726	
PV Unit electricity exported	-360.1261	0.1257	-45.2846	
Total			-86.0572	(269)
Total CO2, kg/year			517.4805	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			19.2500	(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	872.4095	1.1300	985.8227	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1890.1594	1.1300	2135.8802	(278)
Space and water heating			3121.7029	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	79.4629	1.5338	121.8829	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-304.1795	1.4954	-454.8586	
PV Unit electricity exported	-360.1261	0.4616	-166.2244	
Total			-621.0831	(283)
Total Primary energy kWh/year			2752.6035	(286)
Target Primary Energy Rate (TPER)			102.4000	(287)

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Property Reference	Studio Flat 7			Issued on Date	21/08/2023
Assessment Reference	Baseline	Prop Type Ref	Existing 07		
Property					
SAP Rating	88 D	DER	39.44	TER	19.64
Environmental	83 B	% DER < TER			-100.81
CO ₂ Emissions (t/year)	0.84	DFEE	90.82	TFEE	34.11
Compliance Check	See BREL	% DFEE < TFEE			-166.22
% DPER < TPER	-131.12	DPER	242.91	TPER	105.10
Assessor Details				Assessor ID	V922-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	22.9700 (1b)	x 2.8900 (2b)	= 66.3833 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	22.9700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 66.3833 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.3013 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	1.0513 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8936 (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	1.1393	1.1170	1.0946	0.9829	0.9606	0.8489	0.8489	0.8266	0.8936	0.9606	1.0053	1.0500 (22b)
Effective ac	1.1393	1.1170	1.0946	0.9831	0.9614	0.8603	0.8603	0.8416	0.8993	0.9614	1.0053	1.0500 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			1.6200	1.3258	2.1477		(27)
External Wall 1	27.8600	1.6200	26.2400	0.3000	7.8720	135.0000	3542.4000 (29a)
External Roof 1	22.9700		22.9700	0.1600	3.6752	9.0000	206.7300 (30)
Total net area of external elements A _{um} (A, m ²)			50.8300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		13.6949		(33)
Party Wall 1			27.8600	0.0000	0.0000	180.0000	5014.8000 (32)
Party Floor 1			22.9700			40.0000	918.8000 (32d)
Internal Wall 1			34.3900			9.0000	309.5100 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 9992.2400 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 435.0126 (35)
 Thermal bridges (Default value 0.200 * total exposed area) 10.1660 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 23.8609 (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	24.9586	24.4692	23.9798	21.5361	21.0605	18.8467	18.8467	18.4367	19.6994	21.0605	22.0223	23.0011 (38)
Heat transfer coeff	48.8195	48.3302	47.8408	45.3970	44.9215	42.7076	42.7076	42.2976	43.5603	44.9215	45.8832	46.8620 (39)
Average = $\text{Sum}(39)m / 12 =$												45.3541
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	2.1254	2.1041	2.0828	1.9764	1.9557	1.8593	1.8593	1.8414	1.8964	1.9557	1.9975	2.0401 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0616 (42)
Hot water usage for mixer showers	53.8679	53.0584	51.8787	49.6217	47.9560	46.0985	45.0427	46.2135	47.4968	49.4912	51.7967	53.6615 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.5019	24.5745	23.6472	22.7199	21.7925	20.8652	20.8652	21.7925	22.7199	23.6472	24.5745	25.5019 (42c)
Average daily hot water use (litres/day)												72.8479 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	79.3698	77.6329	75.5259	72.3415	69.7486	66.9637	65.9079	68.0060	70.2166	73.1384	76.3712	79.1634 (44)
Energy content (annual)	125.7023	110.5482	116.0805	99.0319	93.8950	82.3397	79.7099	84.2056	86.5841	99.2481	108.8048	123.9507 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1210.1008
Water storage loss:	18.8553	16.5822	17.4121	14.8548	14.0842	12.3510	11.9565	12.6308	12.9876	14.8872	16.3207	18.5926 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	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	176.6612	156.5756	167.0394	148.3470	144.8539	131.6548	130.6688	135.1645	135.8992	150.2070	158.1199	174.9096 (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	176.6612	156.5756	167.0394	148.3470	144.8539	131.6548	130.6688	135.1645	135.8992	150.2070	158.1199	174.9096 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1810.1008 (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	54.5357	48.2641	51.3365	45.2569	43.9598	39.7067	39.2433	40.7381	41.1180	45.7397	48.5064	53.9533 (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	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.0317	56.4994	51.0317	52.7328	51.0317	52.7328	51.0317	51.0317	52.7328	51.0317	52.7328	51.0317 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	81.9531	82.8035	80.6605	76.0982	70.3392	64.9266	61.3106	60.4602	62.6032	67.1654	72.9244	78.3371 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080 (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)	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641 (71)
Water heating gains (Table 5)	73.3007	71.8216	69.0007	62.8568	59.0858	55.1482	52.7463	54.7555	57.1083	61.4781	67.3699	72.5179 (72)
Total internal gains	248.2096	253.0485	242.6169	233.6118	222.3807	211.7316	204.0127	205.1714	211.3683	221.5993	234.9512	243.8108 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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North			1.6200		10.6334		0.7200		0.7000		0.7700		6.0166 (74)	
Solar gains	6.0166	11.4980	19.5379	31.3829	42.2757	45.2574	42.2536	33.5228	23.4909	13.6869	7.4222	5.0157 (83)		
Total gains	254.2261	264.5466	262.1548	264.9948	264.6564	256.9890	246.2662	238.6942	234.8592	235.2862	242.3734	248.8265 (84)		
7. Mean internal temperature (heating season)														
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)		
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	56.8547	57.4304	58.0179	61.1410	61.7883	64.9913	64.9913	65.6212	63.7190	61.7883	60.4932	59.2297		
alpha	4.7903	4.8287	4.8679	5.0761	5.1192	5.3328	5.3328	5.3747	5.2479	5.1192	5.0329	4.9486		
util living area	0.9974	0.9964	0.9945	0.9871	0.9623	0.8668	0.7109	0.7462	0.9238	0.9850	0.9952	0.9977 (86)		
MIT	19.5128	19.6348	19.8486	20.2263	20.5605	20.8624	20.9650	20.9551	20.7733	20.3655	19.9360	19.5602 (87)		
Th 2	19.2511	19.2649	19.2787	19.3491	19.3631	19.4288	19.4288	19.4411	19.4033	19.3631	19.3350	19.3067 (88)		
util rest of house	0.9958	0.9941	0.9907	0.9763	0.9248	0.7373	0.4849	0.5298	0.8329	0.9698	0.9917	0.9963 (89)		
MIT 2	17.9889	18.1205	18.3436	18.7693	19.0949	19.3832	19.4250	19.4352	19.3073	18.9172	18.4737	18.0780 (90)		
Living area fraction	fLA = Living area / (4) =													
MIT	19.0656	19.1904	19.4070	19.7988	20.1305	20.4283	20.5131	20.5091	20.3431	19.9406	19.5069	19.1253 (92)		
Temperature adjustment	0.0000													
adjusted MIT	19.0656	19.1904	19.4070	19.7988	20.1305	20.4283	20.5131	20.5091	20.3431	19.9406	19.5069	19.1253 (93)		
8. Space heating requirement														
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9956	0.9940	0.9911	0.9800	0.9459	0.8283	0.6484	0.6867	0.8947	0.9766	0.9921	0.9961 (94)		
Ext temp.	253.1063	262.9545	259.8092	259.7035	250.3276	212.8755	159.6886	163.9084	210.1269	229.7782	240.4691	247.8611 (95)		
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)		
Space heating kWh	720.8523	690.6596	617.4817	494.7716	378.7085	248.9139	167.1211	173.8058	271.9528	419.5913	569.2701	699.4288 (97)		
Space heating requirement - total per year (kWh/year)	348.0030	287.4179	266.1083	169.2490	95.5154	0.0000	0.0000	0.0000	0.0000	141.2210	236.7367	335.9664 (98a)		
Solar heating kWh												1880.2178		
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)		
Space heating kWh	348.0030	287.4179	266.1083	169.2490	95.5154	0.0000	0.0000	0.0000	0.0000	141.2210	236.7367	335.9664 (98c)		
Space heating requirement after solar contribution - total per year (kWh/year)												1880.2178		
Space heating per m2	(98c) / (4) =											81.8554 (99)		
9a. Energy requirements - Individual heating systems, including micro-CHP														
Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)		
Fraction of space heat from main system(s)												0.9000 (202)		
Efficiency of main space heating system 1 (in %)												79.0000 (206)		
Efficiency of main space heating system 2 (in %)												0.0000 (207)		
Efficiency of secondary/supplementary heating system, %												100.0000 (208)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	348.0030	287.4179	266.1083	169.2490	95.5154	0.0000	0.0000	0.0000	0.0000	141.2210	236.7367	335.9664 (98)		
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000 (210)		
Space heating fuel (main heating system)	396.4591	327.4381	303.1614	192.8153	108.8150	0.0000	0.0000	0.0000	0.0000	160.8847	269.7001	382.7465 (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)	34.8003	28.7418	26.6108	16.9249	9.5515	0.0000	0.0000	0.0000	0.0000	14.1221	23.6737	33.5966 (215)		
Water heating														
Water heating requirement	176.6612	156.5756	167.0394	148.3470	144.8539	131.6548	130.6688	135.1645	135.8992	150.2070	158.1199	174.9096 (64)		
Efficiency of water heater (217)m	80.5156	80.3637	80.0529	79.3047	78.1171	75.0000	75.0000	75.0000	75.0000	78.8733	79.9149	75.0000 (216)		
Fuel for water heating, kWh/month	156.1217	137.5598	145.0047	124.8753	120.1976	109.7863	106.2799	112.2741	115.4455	125.8324	136.1509	154.0496 (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	55.4858	50.1162	55.4858	53.6959	55.4858	53.6959	55.4858	55.4858	53.6959	55.4858	53.6959	55.4858 (231)		
Lighting	10.6034	8.5064	7.6591	5.6114	4.3344	3.5412	3.9540	5.1395	6.6757	8.7589	9.8932	10.8981 (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)		

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

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

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

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	22.9700 (1b)	x 2.8900 (2b)	= 66.3833 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	22.9700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 66.3833 (5)

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2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Air changes per hour			
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.3013	(8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000 (17)		
Infiltration rate	0.5513 (18)		
Number of sides sheltered	2 (19)		
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)		
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4686 (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	0.5975	0.5857	0.5740	0.5154	0.5037	0.4452	0.4452	0.4334	0.4686	0.5037	0.5272	0.5506 (22b)
Effective ac	0.6785	0.6715	0.6648	0.6328	0.6269	0.5991	0.5991	0.5939	0.6098	0.6269	0.6389	0.6516 (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)			1.6200	1.1450	1.8550		(27)					
External Wall 1	27.8600	1.6200	26.2400	0.1800	4.7232		(29a)					
External Roof 1	22.9700		22.9700	0.1100	2.5267		(30)					
Total net area of external elements Aum(A, m2)			50.8300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		9.1049		(33)					
Party Wall 1			27.8600	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							435.0126 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)							2.5415 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	11.6464 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 14.8630	Feb 14.7112	Mar 14.5623	Apr 13.8634	May 13.7326	Jun 13.1238	Jul 13.1238	Aug 13.0111	Sep 13.3583	Oct 13.7326	Nov 13.9971	Dec 14.2737 (38)
Heat transfer coeff	26.5093	26.3575	26.2087	25.5097	25.3790	24.7702	24.7702	24.6574	25.0047	25.3790	25.6435	25.9201 (39)
Average = Sum(39)m / 12 =												25.5091
HLP	Jan 1.1541	Feb 1.1475	Mar 1.1410	Apr 1.1106	May 1.1049	Jun 1.0784	Jul 1.0784	Aug 1.0735	Sep 1.0886	Oct 1.1049	Nov 1.1164	Dec 1.1284 (40)
HLP (average)												1.1105
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.0616 (42)											
Hot water usage for mixer showers	53.8679 53.0584 51.8787 49.6217 47.9560 46.0985 45.0427 46.2135 47.4968 49.4912 51.7967 53.6615 (42a)											
Hot water usage for baths	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)											
Hot water usage for other uses	25.5019 24.5745 23.6472 22.7199 21.7925 20.8652 20.8652 21.7925 22.7199 23.6472 24.5745 25.5019 (42c)											
Average daily hot water use (litres/day)	72.8479 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	79.3698	77.6329	75.5259	72.3415	69.7486	66.9637	65.9079	68.0060	70.2166	73.1384	76.3712	79.1634 (44)
Energy content (annual)	125.7023	110.5482	116.0805	99.0319	93.8950	82.3397	79.7099	84.2056	86.5841	99.2481	108.8048	123.9507 (45)
Distribution loss (46)m = 0.15 x (45)m	18.8553	16.5822	17.4121	14.8548	14.0842	12.3510	11.9565	12.6308	12.9876	14.8872	16.3207	18.5926 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	40.4460	35.7324	38.4872	35.6753	35.5431	33.0232	33.5859	34.6551	34.6274	37.2705	37.6625	40.3408 (61)
Total heat required for water heating calculated for each month												

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WWHRS	166.1483	146.2806	154.5677	134.7072	129.4381	115.3629	113.2959	118.8607	121.2115	136.5186	146.4673	164.2915 (62)
PV diverter	-24.6261	-21.7796	-22.8063	-18.8845	-17.5997	-15.0602	-14.1165	-15.0115	-15.5819	-18.3693	-20.8102	-24.1701 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	141.5221	124.5010	131.7614	115.8227	111.8384	100.3027	99.1793	103.8492	105.6297	118.1493	125.6572	140.1214 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1418.3343 (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	51.9075	45.6904	48.2186	41.8469	40.1059	35.6338	34.9000	36.6621	37.4461	42.3176	45.5932	51.2988 (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	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.0317	56.4994	51.0317	52.7328	51.0317	52.7328	51.0317	51.0317	52.7328	51.0317	52.7328	51.0317	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	81.9531	82.8035	80.6605	76.0982	70.3392	64.9266	61.3106	60.4602	62.6032	67.1654	72.9244	78.3371	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	(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)	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	(71)
Water heating gains (Table 5)	69.7682	67.9916	64.8099	58.1207	53.9057	49.4913	46.9086	49.2771	52.0084	56.8785	63.3239	68.9500	(72)
Total internal gains	244.6770	249.2186	238.4261	228.8758	217.2007	206.0747	198.1750	199.6930	206.2684	216.9997	230.9052	240.2428	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.6200	10.6334		0.6300		0.7000		0.7700		5.2645 (74)
Solar gains	5.2645	10.0608	17.0957	27.4601	36.9912	39.6002	36.9719	29.3325	20.5546	11.9760	6.4945	4.3888	(83)
Total gains	249.9415	259.2793	255.5218	256.3359	254.1919	245.6749	235.1468	229.0254	226.8230	228.9757	237.3996	244.6316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	104.7036	105.3067	105.9046	108.8064	109.3671	112.0550	112.0550	112.5673	111.0042	109.3671	108.2388	107.0838
alpha	7.9802	8.0204	8.0603	8.2538	8.2911	8.4703	8.4703	8.5045	8.4003	8.2911	8.2159	8.1389
util living area	0.9954	0.9924	0.9863	0.9554	0.8565	0.6396	0.4631	0.4946	0.7408	0.9444	0.9879	0.9960 (86)
MIT	20.4293	20.5080	20.6227	20.8114	20.9458	20.9959	20.9997	20.9996	20.9867	20.8588	20.6396	20.4338 (87)
Th 2	20.4230	20.4263	20.4295	20.4447	20.4476	20.4608	20.4608	20.4633	20.4557	20.4476	20.4418	20.4358 (88)
util rest of house	0.9942	0.9904	0.9824	0.9430	0.8231	0.5881	0.4066	0.4372	0.6897	0.9271	0.9843	0.9949 (89)
MIT 2	19.8964	19.9773	20.0934	20.2886	20.4097	20.4588	20.4607	20.4631	20.4483	20.3362	20.1212	19.9120 (90)
Living area fraction	0.7066	0.7066	0.7066	0.7066	0.7066	0.7066	0.7066	0.7066	0.7066	0.7066	0.7066	0.7066 (91)
MIT	20.2730	20.3523	20.4674	20.6580	20.7885	20.8383	20.8416	20.8422	20.8287	20.7055	20.4875	20.2807 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	20.2730	20.3523	20.4674	20.6580	20.7885	20.8383	20.8416	20.8422	20.8287	20.7055	20.4875	20.2807 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9901	0.9827	0.9481	0.8443	0.6243	0.4465	0.4778	0.7252	0.9357	0.9846	0.9946	(94)
Useful gains	248.4029	256.7175	251.0961	243.0386	214.6057	153.3793	105.0015	109.4244	164.4894	214.2551	233.7412	243.3002	(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													
	423.4329	407.2845	366.0667	299.9439	230.6564	154.5226	105.0647	109.5323	168.2494	256.4660	343.3026	416.8140	(97)
Space heating kWh													
	130.2223	101.1810	85.5381	40.9718	11.9417	0.0000	0.0000	0.0000	0.0000	31.4049	78.8842	129.0942	(98a)
Space heating requirement - total per year (kWh/year)													609.2383
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													

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130.2223	101.1810	85.5381	40.9718	11.9417	0.0000	0.0000	0.0000	0.0000	31.4049	78.8842	129.0942 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											609.2383
Space heating per m2											26.5232 (99)

(98c) / (4) =

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	130.2223	101.1810	85.5381	40.9718	11.9417	0.0000	0.0000	0.0000	0.0000	31.4049	78.8842	129.0942 (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)	140.9332	109.5033	92.5737	44.3418	12.9239	0.0000	0.0000	0.0000	0.0000	33.9880	85.3726	139.7124 (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	141.5221	124.5010	131.7614	115.8227	111.8384	100.3027	99.1793	103.8492	105.6297	118.1493	125.6572	140.1214 (64)
Efficiency of water heater	84.2035	83.9406	83.4789	82.3825	81.0565	80.3000	80.3000	80.3000	80.3000	81.9650	83.4120	80.3000 (216)
Fuel for water heating, kWh/month	168.0716	148.3204	157.8380	140.5914	137.9758	124.9100	123.5110	129.3265	131.5438	144.1460	150.6464	84.2061 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	10.6034	8.5064	7.6591	5.6114	4.3344	3.5412	3.9540	5.1395	6.6757	8.7589	9.8932	10.8981 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-11.6000	-16.8105	-24.8504	-28.8025	-31.8680	-30.1227	-29.8437	-27.8291	-24.3197	-19.7030	-12.9479	-9.9832 (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	-5.2163	-11.1100	-22.3115	-33.8140	-44.9591	-45.1883	-44.5664	-37.5410	-27.3236	-15.8853	-6.9712	-4.1076 (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												659.3488 (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												1723.2837 (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)												85.5753 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-567.6749 (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												1986.5330 (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	659.3488	0.2100	138.4632 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1723.2837	0.2100	361.8896 (264)
Space and water heating			500.3528 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	85.5753	0.1443	12.3512 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-268.6807	0.1339	-35.9812
PV Unit electricity exported	-298.9942	0.1257	-37.5775

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Total	-73.5587 (269)
Total CO2, kg/year	451.0746 (272)
EPC Target Carbon Dioxide Emission Rate (TER)	19.6400 (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	659.3488	1.1300	745.0641 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1723.2837	1.1300	1947.3106 (278)
Space and water heating			2692.3747 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	85.5753	1.5338	131.2583 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-268.6807	1.4949	-401.6507
PV Unit electricity exported	-298.9942	0.4613	-137.9336
Total			-539.5843 (283)
Total Primary energy kWh/year			2414.1495 (286)
Target Primary Energy Rate (TPER)			105.1000 (287)

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Property Reference	Studio Flat 7			Issued on Date	21/08/2023
Assessment Reference	Proposed	Prop Type Ref	Existing 07		
Property					
SAP Rating	75 C	DER	8.87	TER	19.65
Environmental	97 A	% DER < TER			65.04
CO ₂ Emissions (t/year)	0.14	DFEE	55.72	TFEE	34.11
Compliance Check	See BREL	% DFEE < TFEE			-63.34
% DPER < TPER	31.91	DPER	71.59	TPER	105.14
Assessor Details				Assessor ID	V922-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	22.9700 (1b)	x 2.8900 (2b)	= 66.3833 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	22.9700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 66.3833 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	20.0000 / (5) = 0.3013 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	5.0000 (17)
Number of sides sheltered	0.5513 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4686 (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	0.5975	0.5857	0.5740	0.5154	0.5037	0.4452	0.4452	0.4334	0.4686	0.5037	0.5272	0.5506 (22b)
Effective ac	0.6785	0.6715	0.6648	0.6328	0.6269	0.5991	0.5991	0.5939	0.6098	0.6269	0.6389	0.6516 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			1.6200	1.3258	2.1477		(27)
External Wall 1	27.8600	1.6200	26.2400	0.1800	4.7232	135.0000	3542.4000 (29a)
External Roof 1	22.9700		22.9700	0.1100	2.5267	9.0000	206.7300 (30)
Total net area of external elements A _{um} (A, m ²)			50.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	9.3976		(33)
Party Wall 1			27.8600	0.0000	0.0000	180.0000	5014.8000 (32)
Party Floor 1			22.9700			40.0000	918.8000 (32d)
Internal Wall 1			34.3900			9.0000	309.5100 (32c)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 9992.2400 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 435.0126 (35)
 Thermal bridges (Default value 0.200 * total exposed area) 10.1660 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 19.5636 (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	14.8630	14.7112	14.5623	13.8634	13.7326	13.1238	13.1238	13.0111	13.3583	13.7326	13.9971	14.2737 (38)
Heat transfer coeff	34.4266	34.2748	34.1260	33.4270	33.2962	32.6874	32.6874	32.5747	32.9219	33.2962	33.5608	33.8374 (39)
Average = Sum(39)m / 12 =												33.4264
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4988	1.4922	1.4857	1.4552	1.4496	1.4230	1.4230	1.4181	1.4333	1.4496	1.4611	1.4731 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0616 (42)
Hot water usage for mixer showers	53.8679	53.0584	51.8787	49.6217	47.9560	46.0985	45.0427	46.2135	47.4968	49.4912	51.7967	53.6615 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.5019	24.5745	23.6472	22.7199	21.7925	20.8652	20.8652	21.7925	22.7199	23.6472	24.5745	25.5019 (42c)
Average daily hot water use (litres/day)												72.8479 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	79.3698	77.6329	75.5259	72.3415	69.7486	66.9637	65.9079	68.0060	70.2166	73.1384	76.3712	79.1634 (44)
Energy conte	125.7023	110.5482	116.0805	99.0319	93.8950	82.3397	79.7099	84.2056	86.5841	99.2481	108.8048	123.9507 (45)
Energy content (annual)												Total = Sum(45)m = 1210.1008
Distribution loss (46)m = 0.15 x (45)m	18.8553	16.5822	17.4121	14.8548	14.0842	12.3510	11.9565	12.6308	12.9876	14.8872	16.3207	18.5926 (46)
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)
If cylinder contains dedicated solar storage												
Primary loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	180.9791	160.4756	171.3573	152.5256	149.1718	135.8334	134.9867	139.4824	140.0778	154.5249	162.2985	179.2275 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	180.9791	160.4756	171.3573	152.5256	149.1718	135.8334	134.9867	139.4824	140.0778	154.5249	162.2985	179.2275 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1860.9406 (64)
Electric shower(s)												1861 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	86.0175	76.6992	82.8182	75.7231	75.4415	70.1729	70.7250	72.2198	71.5842	77.2214	78.9725	85.4351 (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	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.0317	56.4994	51.0317	52.7328	51.0317	52.7328	51.0317	51.0317	52.7328	51.0317	52.7328	51.0317 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	81.9531	82.8035	80.6605	76.0982	70.3392	64.9266	61.3106	60.4602	62.6032	67.1654	72.9244	78.3371 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080 (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)	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641 (71)
Water heating gains (Table 5)	115.6149	114.1358	111.3148	105.1709	101.3999	97.4624	95.0605	97.0696	99.4225	103.7922	109.6841	114.8321 (72)
Total internal gains	287.5237	292.3627	281.9310	272.9260	261.6949	254.0457	246.3268	247.4855	253.6824	260.9134	274.2653	283.1249 (73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.6200	10.6334	0.7200		0.7000		0.7700		6.0166 (74)
Solar gains	6.0166	11.4980	19.5379	31.3829	42.2757	45.2574	42.2536	33.5228	23.4909	13.6869	7.4222	5.0157 (83)
Total gains	293.5403	303.8607	301.4690	304.3089	303.9706	299.3031	288.5803	281.0083	277.1734	274.6003	281.6876	288.1406 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	80.6244	80.9815	81.3346	83.0353	83.3615	84.9140	84.9140	85.2079	84.3092	83.3615	82.7043	82.0283
alpha	6.3750	6.3988	6.4223	6.5357	6.5574	6.6609	6.6609	6.6805	6.6206	6.5574	6.5136	6.4686
util living area	0.9932	0.9900	0.9834	0.9563	0.8756	0.6783	0.4960	0.5295	0.7688	0.9453	0.9848	0.9939 (86)
MIT	20.1978	20.2889	20.4376	20.6773	20.8762	20.9823	20.9980	20.9970	20.9599	20.7532	20.4625	20.1992 (87)
Th 2	19.6884	19.6934	19.6983	19.7212	19.7255	19.7457	19.7457	19.7495	19.7379	19.7255	19.7168	19.7077 (88)
util rest of house	0.9895	0.9845	0.9736	0.9296	0.8057	0.5566	0.3561	0.3878	0.6533	0.9073	0.9753	0.9906 (89)
MIT 2	18.8191	18.9377	19.1275	19.4334	19.6441	19.7398	19.7455	19.7490	19.7214	19.5257	19.1744	18.8359 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	19.7933	19.8924	20.0532	20.3123	20.5147	20.6177	20.6305	20.6308	20.5965	20.3930	20.0845	19.7992 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7933	19.8924	20.0532	20.3123	20.5147	20.6177	20.6305	20.6308	20.5965	20.3930	20.0845	19.7992 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9899	0.9855	0.9767	0.9435	0.8520	0.6429	0.4552	0.4883	0.7349	0.9296	0.9786	0.9909 (94)
Useful gains	290.5726	299.4650	294.4581	287.1267	258.9772	192.4154	131.3587	137.2126	203.6854	255.2742	275.6526	285.5044 (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	533.3806	513.8628	462.5159	381.4790	293.4945	196.7045	131.7457	137.8169	213.8766	326.0711	435.7716	527.8344 (97)
Space heating kWh	180.6492	144.0753	125.0350	67.9337	25.6809	0.0000	0.0000	0.0000	0.0000	52.6729	115.2857	180.2935 (98a)
Space heating requirement - total per year (kWh/year)												891.6263
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	180.6492	144.0753	125.0350	67.9337	25.6809	0.0000	0.0000	0.0000	0.0000	52.6729	115.2857	180.2935 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												891.6263
Space heating per m2												(98c) / (4) = 38.8170 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (301)
Fraction of space heat from community system													0.0000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.5000 (306)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating:													
Space heating requirement	180.6492	144.0753	125.0350	67.9337	25.6809	0.0000	0.0000	0.0000	0.0000	52.6729	115.2857	180.2935 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50													
307a	243.8764	194.5017	168.7973	91.7105	34.6693	0.0000	0.0000	0.0000	0.0000	71.1084	155.6357	243.3962	
Space heating requirement	243.8764	194.5017	168.7973	91.7105	34.6693	0.0000	0.0000	0.0000	0.0000	71.1084	155.6357	243.3962 (307)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)													100.0000 (308)
Space heating fuel for secondary/supplementary system	18.0649	14.4075	12.5035	6.7934	2.5681	0.0000	0.0000	0.0000	0.0000	5.2673	11.5286	18.0294 (309)	
Water heating													
Annual water heating requirement	180.9791	160.4756	171.3573	152.5256	149.1718	135.8334	134.9867	139.4824	140.0778	154.5249	162.2985	179.2275 (64)	
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50													
310a	271.4687	240.7135	257.0360	228.7884	223.7576	203.7501	202.4801	209.2236	210.1167	231.7873	243.4477	268.8413	
Water heating fuel	271.4687	240.7135	257.0360	228.7884	223.7576	203.7501	202.4801	209.2236	210.1167	231.7873	243.4477	268.8413 (310)	
Cooling System Energy Efficiency Ratio													0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)	
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 (331)	
Lighting	10.6034	8.5064	7.6591	5.6114	4.3344	3.5412	3.9548	5.1395	6.6757	8.7589	9.8932	10.8981 (332)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-14.5356	-20.2679	-28.5659	-31.4014	-33.3005	-30.7317	-30.4619	-28.8644	-26.0710	-22.6624	-15.8615	-12.6305 (333a)	

12b. Carbon dioxide emissions - Community heating scheme

13b. Primary energy - Community heating scheme

	Energy kwh/year	Primary energy factor kg CO2/kwh	Primary energy kwh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1141.4590	1.5759	541.9745 (467)
Electrical energy for heat distribution (space & water)	12.0370	0.0000	61.3938 (472)
Overall CO2 factor for heat network			0.4544 (486)
Total CO2 associated with community systems			1815.5024 (473)
Space heating - secondary	89.1626	1.5759	140.5119 (374)
Space and water heating			1956.0143 (476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (478)
Energy for lighting	85.5753	1.5338	131.2583 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-295.3547	1.4991	-442.7798
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-442.7798 (480)
Total Primary energy kwh/year			1644.4929 (483)
Dwelling Primary energy Rate (DPER)			71.5900 (484)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	22.9700 (1b)	x 2.8900 (2b)	= 66.3833 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	22.9700		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 66.3833 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.3013 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		5.0000 (17)
Infiltration rate		0.5513 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4686 (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	0.5975	0.5857	0.5740	0.5154	0.5037	0.4452	0.4452	0.4334	0.4686	0.5037	0.5272	0.5506 (22b)
Effective ac	0.6785	0.6715	0.6648	0.6328	0.6269	0.5991	0.5991	0.5939	0.6098	0.6269	0.6389	0.6516 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			1.6200	1.1450	1.8550		(27)
External Wall 1	27.8600	1.6200	26.2400	0.1800	4.7232		(29a)
External Roof 1	22.9700		22.9700	0.1100	2.5267		(30)
Total net area of external elements Aum(A, m ²)			50.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	9.1049		(33)
Party Wall 1			27.8600	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	435.0126 (35)
Thermal bridges (User defined value 0.050 * total exposed area)	2.5415 (36)
Point Thermal bridges	0.0000 (36a)
Total fabric heat loss	(33) + (36) + (36a) = 11.6464 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	14.8630	14.7112	14.5623	13.8634	13.7326	13.1238	13.1238	13.0111	13.3583	13.7326	13.9971	14.2737 (38)
Average = Sum(39)m / 12 =	26.5093	26.3575	26.2087	25.5097	25.3790	24.7702	24.7702	24.6574	25.0047	25.3790	25.6435	25.9201 (39)
												25.5091
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1541	1.1475	1.1410	1.1106	1.1049	1.0784	1.0784	1.0735	1.0886	1.1049	1.1164	1.1284 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0616 (42)
Hot water usage for mixer showers	53.8679	53.0584	51.8787	49.6217	47.9560	46.0985	45.0427	46.2135	47.4968	49.4912	51.7967	53.6615 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	25.5019	24.5745	23.6472	22.7199	21.7925	20.8652	20.8652	21.7925	22.7199	23.6472	24.5745	25.5019 (42c)
Average daily hot water use (litres/day)												72.8479 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	79.3698	77.6329	75.5259	72.3415	69.7486	66.9637	65.9079	68.0060	70.2166	73.1384	76.3712	79.1634 (44)

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Energy content (annual)	125.7023	110.5482	116.0805	99.0319	93.8950	82.3397	79.7099	84.2056	86.5841	99.2481	108.8048	123.9507 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1210.1008
Water storage loss:	18.8553	16.5822	17.4121	14.8548	14.0842	12.3510	11.9565	12.6308	12.9876	14.8872	16.3207	18.5926 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	172.2972	152.6339	162.6754	144.1238	140.4899	127.4315	126.3048	130.8005	131.6760	145.8430	153.8966	170.5456 (62)
WWHRS	-24.6261	-21.7796	-22.8063	-18.8845	-17.5997	-15.0602	-14.1165	-15.0115	-15.5819	-18.3693	-20.8102	-24.1701 (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	147.6711	130.8544	139.8691	125.2393	122.8902	112.3714	112.1883	115.7890	116.0941	127.4737	133.0865	146.3755 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1529.9024 (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	79.0719	70.4259	75.8727	69.0016	68.4960	63.4514	63.7795	65.2743	64.8627	70.2759	72.2511	78.4895 (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	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801	53.0801 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.0317	56.4994	51.0317	52.7328	51.0317	52.7328	51.0317	51.0317	52.7328	51.0317	52.7328	51.0317 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	81.9531	82.8035	80.6005	76.0982	70.3392	64.9266	61.3106	60.4602	62.6032	67.1654	72.9244	78.3371 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080	28.3080 (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)	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641	-42.4641 (71)
Water heating gains (Table 5)	106.2795	104.8004	101.9794	95.8355	92.0645	88.1270	85.7251	87.7342	90.0871	94.4569	100.3487	105.4967 (72)
Total internal gains	281.1883	286.0273	275.5956	266.5906	255.3595	244.7103	236.9914	238.1502	244.3471	254.5780	267.9299	276.7895 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.6200	10.6334	0.6300	0.7000	0.7700		5.2645 (74)	
Solar gains	5.2645	10.0608	17.0957	27.4601	36.9912	39.6002	36.9719	29.3325	20.5546	11.9760	6.4945	4.3888 (83)
Total gains	286.4528	296.0881	292.6913	294.0507	292.3507	284.3106	273.9633	267.4826	264.9016	266.5541	274.4244	281.1783 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	104.7036	105.3067	105.9046	108.8064	109.3671	112.0550	112.0550	112.5673	111.0042	109.3671	108.2388	107.0838
alpha	7.9802	8.0204	8.0603	8.2538	8.2911	8.4703	8.4703	8.5045	8.4003	8.2911	8.2159	8.1389
util living area	0.9888	0.9825	0.9691	0.9123	0.7768	0.5558	0.3977	0.4239	0.6450	0.8879	0.9705	0.9897 (86)
MIT	20.5308	20.6069	20.7159	20.8805	20.9736	20.9985	20.9999	20.9999	20.9950	20.9193	20.7336	20.5361 (87)
Th 2	20.4230	20.4263	20.4295	20.4447	20.4476	20.4608	20.4608	20.4633	20.4557	20.4476	20.4418	20.4358 (88)
util rest of house	0.9861	0.9782	0.9614	0.8926	0.7392	0.5098	0.3490	0.3745	0.5966	0.8615	0.9628	0.9872 (89)
MIT 2	19.9964	20.0740	20.1829	20.3500	20.4301	20.4601	20.4608	20.4632	20.4531	20.3875	20.2115	20.0130 (90)
Living area fraction									fLA = Living area / (4) =			0.7066 (91)
MIT	20.3740	20.4506	20.5595	20.7248	20.8141	20.8405	20.8417	20.8424	20.8360	20.7633	20.5804	20.3826 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3740	20.4506	20.5595	20.7248	20.8141	20.8405	20.8417	20.8424	20.8360	20.7633	20.5804	20.3826 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9784	0.9633	0.9030	0.7645	0.5423	0.3834	0.4094	0.6306	0.8771	0.9649	0.9869	(94)
Useful gains	282.3912	289.6924	281.9491	265.5148	223.4916	154.1734	105.0490	109.5057	167.0456	233.8019	264.7869	277.5083	(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	426.1099	409.8743	368.4815	301.6478	231.3059	154.5790	105.0683	109.5383	168.4321	257.9331	345.6858	419.4546	(97)
Space heating kWh	106.9268	80.7622	64.3801	26.0157	5.8139	0.0000	0.0000	0.0000	0.0000	17.9536	58.2472	105.6081	(98a)
Space heating requirement - total per year (kWh/year)												465.7076	
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	106.9268	80.7622	64.3801	26.0157	5.8139	0.0000	0.0000	0.0000	0.0000	17.9536	58.2472	105.6081	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												465.7076	
Space heating per m2										(98c) / (4) =		20.2746	(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	106.9268	80.7622	64.3801	26.0157	5.8139	0.0000	0.0000	0.0000	0.0000	17.9536	58.2472	105.6081	(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)	115.8470	87.4997	69.7509	28.1860	6.2989	0.0000	0.0000	0.0000	0.0000	19.4514	63.1064	114.4183	(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	147.6711	130.8544	139.8691	125.2393	122.8902	112.3714	112.1883	115.7890	116.0941	127.4737	133.0865	146.3755	(64)
Efficiency of water heater													79.8000 (216)
(217)m	83.3478	83.0109	82.4334	81.2158	80.1670	79.8000	79.8000	79.8000	79.8000	80.8111	82.3405	83.3400	(217)
Fuel for water heating, kWh/month	177.1746	157.6352	169.6752	154.2056	153.2927	140.8162	140.5868	145.0990	145.4814	157.7427	161.6293	175.6365	(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	10.6034	8.5064	7.6591	5.6114	4.3344	3.5412	3.9540	5.1395	6.6757	8.7589	9.8932	10.8981	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6000	-16.8105	-24.8504	-28.8025	-31.8680	-30.1227	-29.8437	-27.8291	-24.3197	-19.7030	-12.9479	-9.9832	(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	-5.2163	-11.1100	-22.3115	-33.8140	-44.9591	-45.1883	-44.5664	-37.5410	-27.3236	-15.8853	-6.9712	-4.1076	(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													504.5586 (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													1878.9751 (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)													85.5753 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-567.6749 (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													1987.4342 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	504.5586	0.2100	105.9573 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1878.9751	0.2100	394.5848 (264)
Space and water heating			500.5421 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	85.5753	0.1443	12.3512 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-268.6807	0.1339	-35.9812
PV Unit electricity exported	-298.9942	0.1257	-37.5775
Total			-73.5587 (269)
Total CO2, kg/year			451.2638 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			19.6500 (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	504.5586	1.1300	570.1512 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1878.9751	1.1300	2123.2419 (278)
Space and water heating			2693.3931 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	85.5753	1.5338	131.2583 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-268.6807	1.4949	-401.6507
PV Unit electricity exported	-298.9942	0.4613	-137.9336
Total			-539.5843 (283)
Total Primary energy kWh/year			2415.1679 (286)
Target Primary Energy Rate (TPER)			105.1400 (287)

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Property Reference	Studio Flat 8				Issued on Date	21/08/2023	
Assessment Reference	Baseline			Prop Type Ref	Existing 08		
Property							
SAP Rating	66 D		DER	35.99		TER	18.34
Environmental	78 C		% DER < TER				-96.24
CO ₂ Emissions (t/year)	1.29		DFEE	101.50		TFEE	53.45
Compliance Check	See BREL		% DFEE < TFEE				-90.08
% DPER < TPER	-122.05		DPER	215.54		TPER	97.07
Assessor Details						Assessor ID	V922-0001
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	21.7400 (1b)	x 3.5900 (2b)	= 78.0466 (1b) -
First floor	16.9800 (1c)	x 3.0700 (2c)	= 52.1286 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	130.1752 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.1536 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9036 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.7003 (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	0.8929	0.8754	0.8579	0.7704	0.7528	0.6653	0.6653	0.6478	0.7003	0.7528	0.7879	0.8229 (22b)
Effective ac	0.8986	0.8832	0.8680	0.7967	0.7834	0.7213	0.7213	0.7098	0.7452	0.7834	0.8104	0.8386 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			8.8900	1.3258	11.7860		(27)
External Wall 1	59.4300	6.1400	53.2900	0.3000	15.9870	17.0000	905.9300 (29a)
Loft walls	4.3200		4.3200	0.1800	0.7776	9.0000	38.8800 (29a)
Dormer wall	14.3800	2.7500	11.6300	0.3000	3.4890	9.0000	104.6700 (29a)
Sloping	26.2100		26.2100	0.1600	4.1936	9.0000	235.8900 (30)
External Roof 2	3.0600		3.0600	0.1600	0.4896	9.0000	27.5400 (30)
Total net area of external elements A _{um} (A, m ²)			107.4000				(31)

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Fabric heat loss, W/K = Sum (A x U)

Party Wall 1	36.3400	(26)...(30) + (32) =	36.7228	(33)
Party Floor 1	23.8200	0.0000	0.0000	180.0000 (32)
Internal Wall 1	31.8000			30.0000 714.6000 (32d)
Internal Floor 1	14.9000			9.0000 286.2000 (32c)
Internal Ceiling 1	14.9000			18.0000 268.2000 (32d)
				9.0000 134.1000 (32e)

Heat capacity Cm = Sum(A x k)

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

Thermal bridges (Default value 0.200 * total exposed area)

Point Thermal bridges

Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 9257.2100 (34)

239.0808 (35)

21.4800 (36)

(36a) = 0.0000

(33) + (36) + (36a) = 58.2028 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	38.6037	37.9387	37.2869	34.2254	33.6526	30.9861	30.9861	30.4923	32.0132	33.6526	34.8114	36.0228	(38)
Average = Sum(39)m / 12 =	96.8065	96.1415	95.4897	92.4282	91.8554	89.1889	89.1889	88.6951	90.2160	91.8554	93.0142	94.2256	(39)
												92.4255	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.5002	2.4830	2.4662	2.3871	2.3723	2.3034	2.3034	2.2907	2.3300	2.3723	2.4022	2.4335	(40)
HLP (average)												2.3870	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3727 (42)
Hot water usage for mixer showers	60.5919	59.6814	58.3545	55.8157	53.9422	51.8528	50.6652	51.9821	53.4256	55.6689	58.2622	60.3598	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	28.6883	27.6451	26.6019	25.5587	24.5155	23.4722	23.4722	24.5155	25.5587	26.6019	27.6451	28.6883	(42c)
Average daily hot water use (litres/day)												81.9440	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.2802	87.3265	84.9563	81.3744	78.4576	75.3250	74.1374	76.4975	78.9842	82.2708	85.9073	89.0481	(44)
Energy conte	141.3981	124.3517	130.5747	111.3974	105.6190	92.6209	89.6628	94.7199	97.3955	111.6407	122.3907	139.4278	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	21.2097	18.6528	19.5862	16.7096	15.8429	13.8931	13.4494	14.2080	14.6093	16.7461	18.3586	20.9142	(46)

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month													
WWHRS	192.3570	170.3791	181.5336	160.7125	156.5779	141.9360	140.6217	145.6788	146.7105	162.5996	171.7058	190.3867	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	192.3570	170.3791	181.5336	160.7125	156.5779	141.9360	140.6217	145.6788	146.7105	162.5996	171.7058	190.3867	(64)
Total per year (kWh/year) = Sum(64)m =												1961.1992	(64)
												1961	(64)

12Total per year (kWh/year)

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

Heat gains from water heating, kWh/month	59.7546	52.8538	56.1558	49.3684	47.8581	43.1252	42.5526	44.2341	44.7128	49.8602	53.0237	59.0995	(65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.6830	66.0776	59.6830	61.6724	59.6830	61.6724	59.6830	59.6830	61.6724	59.6830	61.6724	59.6830	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	118.3282	119.5561	116.4619	109.8747	101.5595	93.7444	88.5235	87.2956	90.3898	96.9770	105.2922	113.1072	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	(71)
Water heating gains (Table 5)	80.3153	78.6515	75.4783	68.5672	64.3253	59.8961	57.1944	59.4544	62.1010	67.0165	73.6440	79.4348	(72)
Total internal gains	304.9177	310.8763	298.2143	286.7055	272.1590	258.9042	248.9920	250.0242	257.7545	270.2677	287.1998	298.8162	(73)

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North					6.1400	10.6334	0.7200		0.7000		0.7700	22.8036 (74)
Northeast					2.7500	11.2829	0.7200		0.7000		0.7700	10.8372 (75)
Solar gains	33.6409	65.6384	113.7954	184.2167	247.9678	265.0687	247.6487	196.8136	137.4625	78.8335	41.7673	27.8605 (83)
Total gains	338.5586	376.5148	412.0098	470.9222	520.1268	523.9729	496.6407	446.8378	395.2170	349.1011	328.9670	326.6767 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.5628	26.7465	26.9290	27.8210	27.9945	28.8315	28.8315	28.9920	28.5032	27.9945	27.6458	27.2903
alpha	2.7709	2.7831	2.7953	2.8547	2.8663	2.9221	2.9221	2.9328	2.9002	2.8663	2.8431	2.8194
util living area	0.9896	0.9851	0.9760	0.9492	0.8894	0.7760	0.6520	0.7109	0.8822	0.9638	0.9847	0.9907 (86)
MIT	18.0709	18.3032	18.7431	19.4391	20.0874	20.6133	20.8384	20.7868	20.3578	19.5580	18.7524	18.0927 (87)
Th 2	19.0207	19.0308	19.0407	19.0878	19.0967	19.1387	19.1387	19.1466	19.1224	19.0967	19.0787	19.0600 (88)
util rest of house	0.9857	0.9795	0.9662	0.9257	0.8307	0.6427	0.4297	0.4991	0.7920	0.9423	0.9778	0.9873 (89)
MIT 2	16.5266	16.7629	17.2043	17.9120	18.5203	18.9785	19.1081	19.0980	18.7939	18.0446	17.2404	16.5721 (90)
Living area fraction	f _{LA} = Living area / (4) =											
MIT	17.1185	17.3533	17.7941	18.4973	19.1209	19.6050	19.7712	19.7453	19.3933	18.6247	17.8199	17.1549 (92)
Temperature adjustment												
adjusted MIT	16.9685	17.2033	17.6441	18.3473	18.9709	19.4550	19.6212	19.5953	19.2433	18.4747	17.6699	17.0049 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9794	0.9714	0.9556	0.9129	0.8256	0.6704	0.4968	0.5610	0.7999	0.9318	0.9700	0.9815 (94)
Useful gains	331.5787	365.7624	393.7140	429.9022	429.4399	351.2464	246.7495	250.6751	316.1314	325.2954	319.0823	320.6486 (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	1226.3918	1182.8548	1064.1424	873.1966	667.8745	433.0146	269.4615	283.4037	464.0034	723.3292	983.1501	1206.5528 (97)
Space heating kWh	665.7409	549.0861	498.7988	319.1719	177.3953	0.0000	0.0000	0.0000	0.0000	296.1372	478.1288	659.1127 (98a)
Space heating requirement - total per year (kWh/year)												3643.5717
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	665.7409	549.0861	498.7988	319.1719	177.3953	0.0000	0.0000	0.0000	0.0000	296.1372	478.1288	659.1127 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3643.5717
Space heating per m2												(98c) / (4) = 94.1005 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												79.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	665.7409	549.0861	498.7988	319.1719	177.3953	0.0000	0.0000	0.0000	0.0000	296.1372	478.1288	659.1127 (98)
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000 (210)
Space heating fuel (main heating system)	758.4390	625.5411	568.2517	363.6136	202.0959	0.0000	0.0000	0.0000	0.0000	337.3714	544.7037	750.8879 (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)	66.5741	54.9086	49.8799	31.9172	17.7395	0.0000	0.0000	0.0000	0.0000	29.6137	47.8129	65.9113 (215)
Water heating												
Water heating requirement	192.3570	170.3791	181.5336	160.7125	156.5779	141.9360	140.6217	145.6788	146.7105	162.5996	171.7058	190.3867 (64)
Efficiency of water heater	81.6198	81.4928	81.1945	80.5330	79.2890	75.0000	75.0000	75.0000	75.0000	80.3467	81.2202	75.0000 (216)
Fuel for water heating, kWh/month	173.2400	152.5922	160.8173	138.3253	133.2077	123.4946	119.5504	126.2932	129.8606	138.9487	150.6900	170.8250 (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	55.4858	50.1162	55.4858	53.6959	55.4858	53.6959	55.4858	55.4858	53.6959	55.4858	53.6959	55.4858 (231)

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Lighting	12.4009	9.9485	8.9575	6.5627	5.0692	4.1416	4.6243	6.0108	7.8075	10.2438	11.5704	12.7456 (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												4150.9045 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												364.3572 (215)
Efficiency of water heater												75.0000
Water heating fuel used												1717.8449 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												53.3000 (230c)
maintaining electric keep-hot facility for gas combi boiler												600.0000 (230f)
Total electricity for the above, kWh/year												653.3000 (231)
Electricity for lighting (calculated in Appendix L)												100.0827 (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												6986.4893 (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	4150.9045	0.2100	871.6899 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	364.3572	0.1541	56.1651 (263)
Water heating (other fuel)	1717.8449	0.2100	360.7474 (264)
Space and water heating			1288.6025 (265)
Pumps, fans and electric keep-hot	653.3000	0.1387	90.6208 (267)
Energy for lighting	100.0827	0.1443	14.4450 (268)
Total CO2, kg/year			1393.6683 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			35.9900 (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	4150.9045	1.1300	4690.5221 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	364.3572	1.5707	572.2979 (277)
Water heating (other fuel)	1717.8449	1.1300	1941.1648 (278)
Space and water heating			7203.9848 (279)
Pumps, fans and electric keep-hot	653.3000	1.5128	988.3122 (281)
Energy for lighting	100.0827	1.5338	153.5102 (282)
Total Primary energy kWh/year			8345.8072 (286)
Dwelling Primary energy Rate (DPER)			215.5400 (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	21.7400 (1b)	x 3.5900 (2b)	= 78.0466 (1b) -

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First floor
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 38.7200 16.9800 (1c) x 3.0700 (2c) = 52.1286 (1c) -
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 130.1752 (5)

2. Ventilation rate

m3 per hour

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1536 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.4036 (18)
Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3128 (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	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2894	0.3128	0.3363	0.3519	0.3676 (22b)
Effective ac	0.5795	0.5765	0.5734	0.5592	0.5565	0.5442	0.5442	0.5419	0.5489	0.5565	0.5619	0.5676 (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)			8.8900	1.1450	10.1794		(27)
External Wall 1	59.4300	6.1400	53.2900	0.1800	9.5922		(29a)
Loft walls	4.3200		4.3200	0.1800	0.7776		(29a)
Dormer wall	14.3800	2.7500	11.6300	0.1800	2.0934		(29a)
Sloping	26.2100		26.2100	0.1100	2.8831		(30)
External Roof 2	3.0600		3.0600	0.1100	0.3366		(30)
Total net area of external elements Aum(A, m2)			107.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.8623		(33)
Party Wall 1			36.3400	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.0808 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							5.3700 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	31.2323 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.8957	24.7631	24.6330	24.0221	23.9079	23.3758	23.3758	23.2773	23.5808	23.9079	24.1391	24.3808 (38)
Heat transfer coeff	56.1280	55.9953	55.8653	55.2544	55.1401	54.6081	54.6081	54.5096	54.8130	55.1401	55.3714	55.6131 (39)
Average = Sum(39)m / 12 =												55.2539
HLP	1.4496	1.4462	1.4428	1.4270	1.4241	1.4103	1.4103	1.4078	1.4156	1.4241	1.4300	1.4363 (40)
HLP (average)												1.4270
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3727 (42)
Hot water usage for mixer showers	60.5919	59.6814	58.3545	55.8157	53.9422	51.8528	50.6652	51.9821	53.4256	55.6689	58.2622	60.3598 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	28.6883	27.6451	26.6019	25.5587	24.5155	23.4722	23.4722	24.5155	25.5587	26.6019	27.6451	28.6883 (42c)
Average daily hot water use (litres/day)												81.9440 (43)
Daily hot water use	89.2802	87.3265	84.9563	81.3744	78.4576	75.3250	74.1374	76.4975	78.9842	82.2708	85.9073	89.0481 (44)
Energy conte	141.3981	124.3517	130.5747	111.3974	105.6190	92.6209	89.6628	94.7199	97.3955	111.6407	122.3907	139.4278 (45)

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Energy content (annual)											Total = Sum(45)m =	1361.1992
Distribution loss (46)m = 0.15 x (45)m	21.2097	18.6528	19.5862	16.7096	15.8429	13.8931	13.4494	14.2080	14.6093	16.7461	18.3586	20.9142 (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	45.4962	40.1941	43.2928	40.1298	39.9811	37.1466	37.7796	38.9823	38.9511	41.9243	42.3652	45.3779 (61)
Total heat required for water heating calculated for each month	186.8943	164.5458	173.8676	151.5273	145.6002	129.7675	127.4424	133.7022	136.3466	153.5650	164.7559	184.8057 (62)
WVHRS	-27.7001	-24.4982	-25.6531	-21.2418	-19.7966	-16.9401	-15.8786	-16.8853	-17.5269	-20.6622	-23.4078	-27.1871 (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	159.1942	140.0476	148.2145	130.2855	125.8036	112.8274	111.5638	116.8169	118.8197	132.9027	141.3481	157.6186 (64)
	Total per year (kWh/year) = Sum(64)m =										1595.4426	1595 (64)
12Total per year (kWh/year)												
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										0.0000 (64a)	
Heat gains from water heating, kWh/month	58.3889	51.3955	54.2393	47.0721	45.1136	40.0831	39.2578	41.2399	42.1218	47.6016	51.2862	57.7042 (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	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.6830	66.0776	59.6830	61.6724	59.6830	61.6724	59.6830	59.6830	61.6724	59.6830	61.6724	59.6830	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	118.3282	119.5561	116.4619	109.8747	101.5595	93.7444	88.5235	87.2956	90.3898	96.9770	105.2922	113.1072	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	(71)
Water heating gains (Table 5)	78.4797	76.4813	72.9023	65.3779	60.6366	55.6710	52.7659	55.4300	58.5025	63.9806	71.2309	77.5594	(72)
Total internal gains	303.0821	308.7062	295.6384	283.5162	268.4703	254.6790	244.5635	245.9998	254.1559	267.2318	284.7866	296.9409	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				6.1400	10.6334	0.6300		0.7000	0.7700		19.9532 (74)	
Northeast				2.7500	11.2829	0.6300		0.7000	0.7700		9.4826 (75)	
Solar gains	29.4358	57.4336	99.5710	161.1896	216.9718	231.9351	216.6926	172.2119	120.2797	68.9793	36.5464	24.3779 (83)
Total gains	332.5179	366.1398	395.2094	444.7058	485.4420	486.6141	461.2561	418.2117	374.4356	336.2111	321.3330	321.3188 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.8140	45.9225	46.0294	46.5383	46.6348	47.0891	47.0891	47.1742	46.9130	46.6348	46.4400	46.2382
alpha	4.0543	4.0615	4.0686	4.1026	4.1090	4.1393	4.1393	4.1449	4.1275	4.1090	4.0960	4.0825
util living area	0.9903	0.9846	0.9716	0.9282	0.8257	0.6553	0.5035	0.5685	0.8090	0.9507	0.9835	0.9916 (86)
MIT	19.3497	19.5306	19.8422	20.3029	20.6947	20.9163	20.9781	20.9645	20.7944	20.3079	19.7645	19.3250 (87)
Th 2	19.7255	19.7281	19.7307	19.7427	19.7449	19.7554	19.7554	19.7574	19.7514	19.7449	19.7404	19.7356 (88)
util rest of house	0.9872	0.9796	0.9620	0.9029	0.7664	0.5516	0.3696	0.4295	0.7222	0.9279	0.9773	0.9889 (89)
MIT 2	17.8534	18.0845	18.4790	19.0518	19.4946	19.7095	19.7490	19.7454	19.6135	19.0722	18.3917	17.8287 (90)
Living area fraction	18.4269	18.6388	19.0015	19.5313	19.9546	20.1720	20.2200	20.2127	20.0661	19.5458	18.9179	18.4021 (92)
MIT	18.4269	18.6388	19.0015	19.5313	19.9546	20.1720	20.2200	20.2127	20.0661	19.5458	18.9179	18.4021 (93)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
adjusted MIT	18.4269	18.6388	19.0015	19.5313	19.9546	20.1720	20.2200	20.2127	20.0661	19.5458	18.9179	18.4021 (93)

8. Space heating requirement

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

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Utilisation	0.9827	0.9737	0.9547	0.8977	0.7775	0.5884	0.4211	0.4828	0.7470	0.9233	0.9716	0.9848 (94)
Useful gains	326.7501	356.5095	377.2910	399.2254	377.4491	286.3447	194.2522	201.9035	279.7099	310.4121	312.2079	316.4208 (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	792.9123	769.3065	698.3995	587.4246	455.1576	304.2771	197.6831	207.8270	327.0202	493.2723	654.3713	789.8243 (97)
Space heating kWh	346.8247	277.3996	238.9047	135.5035	57.8151	0.0000	0.0000	0.0000	0.0000	136.0480	246.3576	352.2122 (98a)
Space heating requirement - total per year (kWh/year)												1791.0654
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	346.8247	277.3996	238.9047	135.5035	57.8151	0.0000	0.0000	0.0000	0.0000	136.0480	246.3576	352.2122 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1791.0654
Space heating per m2										(98c) / (4) =		46.2569 (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	346.8247	277.3996	238.9047	135.5035	57.8151	0.0000	0.0000	0.0000	0.0000	136.0480	246.3576	352.2122 (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)	375.3514	300.2160	258.5549	146.6488	62.5705	0.0000	0.0000	0.0000	0.0000	147.2381	266.6208	381.1821 (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	159.1942	140.0476	148.2145	130.2855	125.8036	112.8274	111.5638	116.8169	118.8197	132.9027	141.3481	157.6186 (64)
Efficiency of water heater (217)m	86.0023	85.8166	85.3983	84.4657	82.8227	80.3000	80.3000	80.3000	80.3000	84.4316	85.5593	86.0508 (217)
Fuel for water heating, kWh/month	185.1046	163.1940	173.5567	154.2466	151.8950	140.5074	138.9338	145.4755	147.9698	157.4087	165.2049	183.1692 (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	12.4009	9.9485	8.9575	6.5627	5.0692	4.1416	4.6243	6.0108	7.8075	10.2438	11.5704	12.7456 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-18.6964	-26.6671	-38.8053	-44.2368	-48.2850	-45.3560	-44.8653	-42.1010	-37.2613	-30.8323	-20.6897	-16.1338 (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	-9.6505	-20.3979	-40.6944	-61.3145	-81.2207	-81.5939	-80.5660	-68.0918	-49.7926	-29.1581	-12.8874	-7.6186 (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												1938.3825 (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												1906.6661 (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)												100.0827 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-956.9165 (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												3074.2148 (238)

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1938.3825	0.2100	407.0603 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1906.6661	0.2100	400.3999 (264)
Space and water heating			807.4602 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	100.0827	0.1443	14.4450 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-413.9300	0.1343	-55.5820
PV Unit electricity exported	-542.9865	0.1258	-68.3206
Total			-123.9027 (269)
Total CO2, kg/year			709.9318 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.3400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1938.3825	1.1300	2190.3722 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1906.6661	1.1300	2154.5327 (278)
Space and water heating			4344.9049 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	100.0827	1.5338	153.5102 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-413.9300	1.4963	-619.3445
PV Unit electricity exported	-542.9865	0.4619	-250.7830
Total			-870.1275 (283)
Total Primary energy kWh/year			3758.3885 (286)
Target Primary Energy Rate (TPER)			97.0700 (287)

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Property Reference	Studio Flat 8				Issued on Date	21/08/2023	
Assessment Reference	Proposed			Prop Type Ref	Existing 08		
Property							
SAP Rating	70 C		DER	7.47		TER	18.04
Environmental	96 A		% DER < TER				58.59
CO ₂ Emissions (t/year)	0.27		DFEE	77.13		TFEE	53.45
Compliance Check	See BREL		% DFEE < TFEE				-44.31
% DPER < TPER	19.23		DPER	77.09		TPER	95.45
Assessor Details						Assessor ID	V922-0001
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	21.7400 (1b)	x 3.5900 (2b)	= 78.0466 (1b) -
First floor	16.9800 (1c)	x 3.0700 (2c)	= 52.1286 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	130.1752 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1536 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4036	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3128 (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	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2894	0.3128	0.3363	0.3519	0.3676 (22b)
Effective ac	0.5795	0.5765	0.5734	0.5592	0.5565	0.5442	0.5442	0.5419	0.5489	0.5565	0.5619	0.5676 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			8.8900	1.3258	11.7860		(27)
External Wall 1	59.4300	6.1400	53.2900	0.1800	9.5922	17.0000	905.9300 (29a)
Loft walls	4.3200		4.3200	0.1800	0.7776	9.0000	38.8800 (29a)
Dormer wall	14.3800	2.7500	11.6300	0.1500	1.7445	9.0000	104.6700 (29a)
Sloping	26.2100		26.2100	0.1500	3.9315	9.0000	235.8900 (30)
External Roof 2	3.0600		3.0600	0.1800	0.5508	9.0000	27.5400 (30)
Total net area of external elements A _{um} (A, m ²)			107.4000				(31)

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Fabric heat loss, W/K = Sum (A x U)

Party Wall 1	36.3400	0.0000	0.0000	180.0000	6541.2000	(32)
Party Floor 1	23.8200			30.0000	714.6000	(32d)
Internal Wall 1	31.8000			9.0000	286.2000	(32c)
Internal Floor 1	14.9000			18.0000	268.2000	(32d)
Internal Ceiling 1	14.9000			9.0000	134.1000	(32e)

Heat capacity Cm = Sum(A x k)

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

Thermal bridges (Default value 0.200 * total exposed area)

Point Thermal bridges

Total fabric heat loss

(26)...(30) + (32) + (32a)...(32e) = 9257.2100 (34)

239.0808 (35)

21.4800 (36)

0.0000 (36a) =

(33) + (36) + (36a) = 49.8626 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	24.8957	24.7631	24.6330	24.0221	23.9079	23.3758	23.3758	23.2773	23.5808	23.9079	24.1391	24.3808	(38)
Heat transfer coeff	74.7583	74.6256	74.4956	73.8847	73.7704	73.2384	73.2384	73.1399	73.4433	73.7704	74.0016	74.2434	(39)
Average = Sum(39)m / 12 =												73.8842	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9307	1.9273	1.9240	1.9082	1.9052	1.8915	1.8915	1.8889	1.8968	1.9052	1.9112	1.9174	(40)
HLP (average)												1.9082	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3727 (42)
Hot water usage for mixer showers	60.5919	59.6814	58.3545	55.8157	53.9422	51.8528	50.6652	51.9821	53.4256	55.6689	58.2622	60.3598	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	28.6883	27.6451	26.6019	25.5587	24.5155	23.4722	23.4722	24.5155	25.5587	26.6019	27.6451	28.6883	(42c)
Average daily hot water use (litres/day)												81.9440	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.2802	87.3265	84.9563	81.3744	78.4576	75.3250	74.1374	76.4975	78.9842	82.2708	85.9073	89.0481	(44)
Energy content (annual)	141.3981	124.3517	130.5747	111.3974	105.6190	92.6209	89.6628	94.7199	97.3955	111.6407	122.3907	139.4278	(45)
Distribution loss (46)m = 0.15 x (45)m													
	21.2097	18.6528	19.5862	16.7096	15.8429	13.8931	13.4494	14.2080	14.6093	16.7461	18.3586	20.9142	(46)

Water storage loss:

Store volume

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day)

Volume factor from Table 2a

Temperature factor from Table 2b

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

Total storage loss

	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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

	196.6749	174.2791	185.8515	164.8911	160.8958	146.1146	144.9396	149.9967	150.8891	166.9175	175.8844	194.7046	(62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h	196.6749	174.2791	185.8515	164.8911	160.8958	146.1146	144.9396	149.9967	150.8891	166.9175	175.8844	194.7046	(64)
12Total per year (kWh/year)												2012.0390	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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

Heat gains from water heating, kWh/month

	91.2363	81.2889	87.6375	79.8346	79.3398	73.5914	74.0343	75.7158	75.1789	81.3420	83.4898	90.5812	(65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.6830	66.0776	59.6830	61.6724	59.6830	61.6724	59.6830	59.6830	61.6724	59.6830	61.6724	59.6830	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	118.3282	119.5561	116.4619	109.8747	101.5595	93.7444	88.5235	87.2956	90.3898	96.9770	105.2922	113.1072	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	(71)
Water heating gains (Table 5)	122.6294	120.9656	117.7924	110.8814	106.6395	102.2103	99.5085	101.7686	104.4152	109.3306	115.9581	121.7489	(72)

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Total internal gains
344.2318 350.1905 337.5285 326.0197 311.4732 301.2183 291.3062 292.3383 300.0686 309.5818 326.5139 338.1303 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			6.1400	10.6334	0.7200	0.7000	0.7700	22.8036 (74)				
Northeast			2.7500	11.2829	0.7200	0.7000	0.7700	10.8372 (75)				
Solar gains	33.6409	65.6384	113.7954	184.2167	247.9678	265.0687	247.6487	196.8136	137.4625	78.8335	41.7673	27.8605 (83)
Total gains	377.8727	415.8289	451.3239	510.2364	559.4409	566.2870	538.9549	489.1519	437.5311	388.4153	368.2812	365.9908 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.3968	34.4580	34.5181	34.8035	34.8574	35.1106	35.1106	35.1579	35.0127	34.8574	34.7485	34.6354	
alpha	3.2931	3.2972	3.3012	3.3202	3.3238	3.3407	3.3407	3.3439	3.3342	3.3238	3.3166	3.3090	
util living area	0.9863	0.9800	0.9666	0.9268	0.8402	0.6923	0.5496	0.6113	0.8222	0.9457	0.9785	0.9877 (86)	
MIT	18.8111	19.0145	19.3887	19.9436	20.4578	20.8071	20.9345	20.9058	20.6305	19.9964	19.3243	18.7812 (87)	
Th 2	19.3799	19.3822	19.3845	19.3952	19.3973	19.4067	19.4067	19.4084	19.4030	19.3973	19.3932	19.3889 (88)	
util rest of house	0.9817	0.9732	0.9543	0.8981	0.7744	0.5666	0.3718	0.4322	0.7227	0.9182	0.9697	0.9836 (89)	
MIT 2	16.9540	17.2127	17.6856	18.3741	18.9638	19.3060	19.3900	19.3805	19.1667	18.4558	17.6152	16.9214 (90)	
Living area fraction									f _{LA} = Living area / (4) =			0.3833 (91)	
MIT	17.6657	17.9033	18.3384	18.9756	19.5364	19.8813	19.9820	19.9651	19.7277	19.0462	18.2703	17.6342 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.6657	17.9033	18.3384	18.9756	19.5364	19.8813	19.9820	19.9651	19.7277	19.0462	18.2703	17.6342 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9743	0.9641	0.9433	0.8884	0.7812	0.6081	0.4404	0.5006	0.7469	0.9101	0.9608	0.9767 (94)	
Useful gains	368.1668	400.9011	425.7531	453.3088	437.0159	344.3783	237.3663	244.8629	326.7984	353.4801	353.8607	357.4798 (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	999.2006	970.3772	881.9054	744.4360	578.0928	386.7964	247.6890	260.7516	413.3191	623.0814	826.6189	997.3988 (97)	
Space heating kWh	469.4892	382.6879	339.3773	209.6116	104.9612	0.0000	0.0000	0.0000	0.0000	200.5833	340.3859	476.0997 (98a)	
Space heating requirement - total per year (kWh/year)												2523.1962	
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	469.4892	382.6879	339.3773	209.6116	104.9612	0.0000	0.0000	0.0000	0.0000	200.5833	340.3859	476.0997 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2523.1962	
Space heating per m2										(98c) / (4) =		65.1652 (99)	

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (301)
Fraction of space heat from community system													0.9000 (302)
Fraction of heat from community Heat pump-Space and Water													1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating													1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating													1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system													1.5000 (306)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating:													
Space heating requirement	469.4892	382.6879	339.3773	209.6116	104.9612	0.0000	0.0000	0.0000	0.0000	200.5833	340.3859	476.0997 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50													
307a	633.8104	516.6287	458.1593	282.9757	141.6977	0.0000	0.0000	0.0000	0.0000	270.7875	459.5210	642.7346	
Space heating requirement	633.8104	516.6287	458.1593	282.9757	141.6977	0.0000	0.0000	0.0000	0.0000	270.7875	459.5210	642.7346 (307)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												100.0000 (308)	
Space heating fuel for secondary/supplementary system	46.9489	38.2688	33.9377	20.9612	10.4961	0.0000	0.0000	0.0000	0.0000	20.0583	34.0386	47.6100 (309)	
Water heating:													
Annual water heating requirement	196.6749	174.2791	185.8515	164.8911	160.8958	146.1146	144.9396	149.9967	150.8891	166.9175	175.8844	194.7046 (64)	
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50													
310a	295.0123	261.4187	278.7773	247.3367	241.3437	219.1719	217.4094	224.9950	226.3337	250.3762	263.8265	292.0569	
Water heating fuel													

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	295.0123	261.4187	278.7773	247.3367	241.3437	219.1719	217.4094	224.9950	226.3337	250.3762	263.8265	292.0569 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
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 (331)
Lighting	12.4009	9.9485	8.9575	6.5627	5.0692	4.1416	4.6243	6.0108	7.8075	10.2438	11.5704	12.7456 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-15.7475	-22.5688	-32.5676	-36.5926	-39.2500	-35.7229	-35.3662	-33.1940	-29.5354	-25.6131	-17.4107	-13.6183 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												3406.3148 (307)
Space heating fuel - secondary												252.3196 (309)
Water heating fuel - community heating												3018.0585 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												34.0631 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (331)
Electricity for lighting (calculated in Appendix L)												100.0827 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-337.1869 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												6439.5887 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1835.5352	0.1545	150.3486 (367)
Electrical energy for heat distribution (space & water)	34.0631	0.0000	9.5075 (372)
Overall CO2 factor for heat network			0.0438 (386)
Total CO2 associated with community systems			281.1513 (373)
Space heating - secondary	252.3196	0.1545	38.9793 (374)
Space and water heating			320.1306 (376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (378)
Energy for lighting	100.0827	0.1443	14.4450 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-337.1869	0.1348	-45.4400
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-45.4400 (380)
Total CO2, kg/year			289.1355 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.4700 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1835.5352	1.5719	1529.8712 (467)
Electrical energy for heat distribution (space & water)	34.0631	0.0000	99.4234 (472)
Overall CO2 factor for heat network			0.4576 (486)
Total CO2 associated with community systems			2940.0924 (473)
Space heating - secondary	252.3196	1.5719	396.6333 (374)
Space and water heating			3336.7257 (476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (478)
Energy for lighting	100.0827	1.5338	153.5102 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-337.1869	1.4981	-505.1315
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-505.1315 (480)
Total Primary energy kWh/year			2985.1044 (483)
Dwelling Primary energy Rate (DPER)			77.0900 (484)

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CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	21.7400 (1b)	x 3.5900 (2b)	= 78.0466 (1b) -
First floor	16.9800 (1c)	x 3.0700 (2c)	= 52.1286 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 130.1752 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1536 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4036 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3128 (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	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2894	0.3128	0.3363	0.3519	0.3676 (22b)
Effective ac	0.5795	0.5765	0.5734	0.5592	0.5565	0.5442	0.5442	0.5419	0.5489	0.5565	0.5619	0.5676 (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)			8.8900	1.1450	10.1794		(27)					
External Wall 1	59.4300	6.1400	53.2900	0.1800	9.5922		(29a)					
Loft walls	4.3200		4.3200	0.1800	0.7776		(29a)					
Dormer wall	14.3800	2.7500	11.6300	0.1800	2.0934		(29a)					
Sloping	26.2100		26.2100	0.1100	2.8831		(30)					
External Roof 2	3.0600		3.0600	0.1100	0.3366		(30)					
Total net area of external elements Aum(A, m2)			107.4000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.8623		(33)					
Party Wall 1			36.3400	0.0000	0.0000		(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							239.0808 (35)					
Thermal bridges (User defined value 0.050 * total exposed area)							5.3700 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	31.2323 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 24.8957	Feb 24.7631	Mar 24.6330	Apr 24.0221	May 23.9079	Jun 23.3758	Jul 23.3758	Aug 23.2773	Sep 23.5808	Oct 23.9079	Nov 24.1391	Dec 24.3808 (38)
Heat transfer coeff	56.1280	55.9953	55.8653	55.2544	55.1401	54.6081	54.6081	54.5096	54.8130	55.1401	55.3714	55.6131 (39)
Average = Sum(39)m / 12 =												55.2539
HLP	Jan 1.4496	Feb 1.4462	Mar 1.4428	Apr 1.4270	May 1.4241	Jun 1.4103	Jul 1.4103	Aug 1.4078	Sep 1.4156	Oct 1.4241	Nov 1.4300	Dec 1.4363 (40)
HLP (average)												1.4270
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.3727 (42)
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Hot water usage for mixer showers	60.5919	59.6814	58.3545	55.8157	53.9422	51.8528	50.6652	51.9821	53.4256	55.6689	58.2622	60.3598 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	28.6883	27.6451	26.6019	25.5587	24.5155	23.4722	23.4722	24.5155	25.5587	26.6019	27.6451	28.6883 (42c)
Average daily hot water use (litres/day)												81.9440 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	89.2802	87.3265	84.9563	81.3744	78.4576	75.3250	74.1374	76.4975	78.9842	82.2708	85.9073	89.0481 (44)
Distribution loss (46)m = 0.15 x (45)m	141.3981	124.3517	130.5747	111.3974	105.6190	92.6209	89.6628	94.7199	97.3955	111.6407	122.3907	139.4278 (45)
Water storage loss:	21.2097	18.6528	19.5862	16.7096	15.8429	13.8931	13.4494	14.2080	14.6093	16.7461	18.3586	20.9142 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	187.9930	166.4374	177.1696	156.4893	152.2139	137.7128	136.2577	141.3148	142.4873	158.2356	167.4825	186.0227 (62)
WVHRS	-27.7001	-24.4982	-25.6531	-21.2418	-19.7966	-16.9401	-15.8786	-16.8853	-17.5269	-20.6622	-23.4078	-27.1871 (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	160.2929	141.9392	151.5165	135.2475	132.4173	120.7727	120.3791	124.4295	124.9604	137.5733	144.0747	158.8355 (64)
12Total per year (kWh/year)												1652.4388 (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	84.2908	75.0155	80.6920	73.1131	72.3942	66.8699	67.0888	68.7703	68.4575	74.3964	76.7684	83.6357 (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	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373	68.6373 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	59.6830	66.0776	59.6830	61.6724	59.6830	61.6724	59.6830	59.6830	61.6724	59.6830	61.6724	59.6830 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	118.3282	119.5561	116.4619	109.8747	101.5595	93.7444	88.5235	87.2956	90.3898	96.9770	105.2922	113.1072 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637	29.8637 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099	-54.9099 (71)
Water heating gains (Table 5)	113.2941	111.6302	108.4570	101.5460	97.3041	92.8749	90.1731	92.4332	95.0798	99.9952	106.6227	112.4135 (72)
Total internal gains	337.8965	343.8551	331.1931	319.6843	305.1378	291.8829	281.9708	283.0030	290.7332	303.2464	320.1785	331.7950 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				6.1400	10.6334		0.6300		0.7000		0.7700		19.9532 (74)
Northeast				2.7500	11.2829		0.6300		0.7000		0.7700		9.4826 (75)
Solar gains	29.4358	57.4336	99.5710	161.1896	216.9718	231.9351	216.6926	172.2119	120.2797	68.9793	36.5464	24.3779	(83)
Total gains	367.3322	401.2887	430.7641	480.8739	522.1096	523.8181	498.6634	455.2149	411.0129	372.2257	356.7249	356.1729	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.8140	45.9225	46.0294	46.5383	46.6348	47.0891	47.0891	47.1742	46.9130	46.6348	46.4400	46.2382
alpha	4.0543	4.0615	4.0686	4.1026	4.1090	4.1393	4.1393	4.1449	4.1275	4.1090	4.0960	4.0825
util living area	0.9862	0.9789	0.9626	0.9108	0.7970	0.6197	0.4694	0.5289	0.7701	0.9332	0.9765	0.9878 (86)
MIT	19.4392	19.6185	19.9256	20.3715	20.7363	20.9319	20.9830	20.9727	20.8316	20.3836	19.8525	19.4154 (87)

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Th 2	19.7255	19.7281	19.7307	19.7427	19.7449	19.7554	19.7554	19.7574	19.7514	19.7449	19.7404	19.7356 (88)
util rest of house	0.9820	0.9723	0.9504	0.8812	0.7339	0.5176	0.3428	0.3965	0.6782	0.9046	0.9680	0.9840 (89)
MIT 2	17.9664	18.1944	18.5809	19.1295	19.5335	19.7190	19.7505	19.7485	19.6427	19.1587	18.5010	17.9430 (90)
Living area fraction									fLA = Living area / (4) =			0.3833 (91)
MIT	18.5309	18.7402	19.0963	19.6055	19.9945	20.1839	20.2229	20.2177	20.0983	19.6282	19.0190	18.5073 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5309	18.7402	19.0963	19.6055	19.9945	20.1839	20.2229	20.2177	20.0983	19.6282	19.0190	18.5073 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9764	0.9655	0.9426	0.8774	0.7477	0.5545	0.3915	0.4473	0.7065	0.9012	0.9613	0.9789 (94)
Useful gains	358.6530	387.4351	406.0250	421.9224	390.3946	290.4579	195.2178	203.6166	290.3816	335.4647	342.9370	348.6542 (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	798.7508	774.9862	703.6942	591.5286	457.3602	304.9242	197.8402	208.1013	328.7870	497.8137	659.9704	795.6734 (97)
Space heating kWh	327.4328	260.4344	221.4659	122.1165	49.8224	0.0000	0.0000	0.0000	0.0000	120.7876	228.2641	332.5823 (98a)
Space heating requirement - total per year (kWh/year)												1662.9059
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	327.4328	260.4344	221.4659	122.1165	49.8224	0.0000	0.0000	0.0000	0.0000	120.7876	228.2641	332.5823 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1662.9059
Space heating per m2										(98c) / (4) =		42.9469 (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	327.4328	260.4344	221.4659	122.1165	49.8224	0.0000	0.0000	0.0000	0.0000	120.7876	228.2641	332.5823 (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)	354.7484	282.1608	239.9414	132.3039	53.9788	0.0000	0.0000	0.0000	0.0000	130.8641	247.3067	360.3275 (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	160.2929	141.9392	151.5165	135.2475	132.4173	120.7727	120.3791	124.4295	124.9604	137.5733	144.0747	158.8355 (64)
Efficiency of water heater	85.6262	85.4023	84.9098	83.8315	82.0741	79.8000	79.8000	79.8000	79.8000	83.7693	85.0868	79.8000 (216)
Fuel for water heating, kWh/month	187.2008	166.2007	178.4441	161.3326	161.3387	151.3442	150.8510	155.9267	156.5920	164.2289	169.3268	185.3892 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	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	12.4009	9.9485	8.9575	6.5627	5.0692	4.1416	4.6243	6.0108	7.8075	10.2438	11.5704	12.7456 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-18.6964	-26.6671	-38.8053	-44.2368	-48.2850	-45.3560	-44.8653	-42.1010	-37.2613	-30.8323	-20.6897	-16.1338 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-9.6505	-20.3979	-40.6944	-61.3145	-81.2207	-81.5939	-80.5660	-68.0918	-49.7926	-29.1581	-12.8874	-7.6186 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1801.6315 (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												1988.1757 (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)												100.0827 (232)

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

PV generation	-956.9165 (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	3018.9735 (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	1801.6315	0.2100	378.3426 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1988.1757	0.2100	417.5169 (264)
Space and water heating			795.8595 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	100.0827	0.1443	14.4450 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-413.9300	0.1343	-55.5820
PV Unit electricity exported	-542.9865	0.1258	-68.3206
Total			-123.9027 (269)
Total CO2, kg/year			698.3311 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.0400 (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	1801.6315	1.1300	2035.8436 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1988.1757	1.1300	2246.6385 (278)
Space and water heating			4282.4822 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	100.0827	1.5338	153.5102 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-413.9300	1.4963	-619.3445
PV Unit electricity exported	-542.9865	0.4619	-250.7830
Total			-870.1275 (283)
Total Primary energy kWh/year			3695.9658 (286)
Target Primary Energy Rate (TPER)			95.4500 (287)

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Property Reference	Studio Flat 9			Issued on Date	21/08/2023
Assessment Reference	Baseline	Prop Type Ref	Existing 09		
Property					
SAP Rating	87 D	DER	34.58	TER	18.00
Environmental	79 C	% DER < TER			-92.11
CO ₂ Emissions (t/year)	1.21	DFEE	96.06	TFEE	51.65
Compliance Check	See BREL	% DFEE < TFEE			-85.97
% DPER < TPER	-118.05	DPER	207.76	TPER	95.28
Assessor Details				Assessor ID	V922-0001
Client					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	17.2200 (1b)	x 2.8900 (2b)	= 49.7658 (1b) -
First floor	20.7200 (1c)	x 2.6800 (2c)	= 55.5296 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	105.2954 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.1899 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9399 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.7285 (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	0.9288	0.9106	0.8924	0.8013	0.7831	0.6920	0.6920	0.6738	0.7285	0.7831	0.8195	0.8559 (22b)
Effective ac	0.9313	0.9146	0.8982	0.8210	0.8066	0.7395	0.7395	0.7270	0.7653	0.8066	0.8358	0.8663 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			9.3600	1.3258	12.4091		(27)
External Wall 1	15.1100	8.1100	7.0000	0.3000	2.1000	17.0000	119.0000 (29a)
Loft walls	64.4000		64.4000	0.1800	11.5920	9.0000	579.6000 (29a)
Dormer wall	1.5700	1.2500	0.3200	0.1800	0.0576	9.0000	2.8800 (29a)
Flat Ceiling	33.7700		33.7700	0.1600	5.4032	9.0000	303.9300 (30)
External Roof 2	1.4700		1.4700	0.1600	0.2352	9.0000	13.2300 (30)
Dormer	1.4700		1.4700	0.1600	0.2352	9.0000	13.2300 (30)

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Total net area of external elements Aum(A, m2)	117.7900												(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	32.0323											(33)
Party Wall 1	66.9600	0.0000	0.0000	180.0000	12052.8000								(32)
Party Floor 1	35.2500			30.0000	1057.5000								(32d)
Party Ceiling 1	8.9100			20.0000	178.2000								(32b)
Internal Wall 1	41.0700			9.0000	369.6300								(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14690.0000											(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													(35)
Thermal bridges (Default value 0.200 * total exposed area)													(36)
Point Thermal bridges													(36a) =
Total fabric heat loss	(33) + (36) + (36a) =	55.5903											(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	32.3609	31.7789	31.2085	28.5291	28.0278	25.6942	25.6942	25.2620	26.5931	28.0278	29.0419	30.1022	(38)
Average = Sum(39)m / 12 =	87.9512	87.3692	86.7988	84.1194	83.6181	81.2845	81.2845	80.8523	82.1833	83.6181	84.6322	85.6924	(39)
	84.1170												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.3182	2.3028	2.2878	2.2172	2.2040	2.1424	2.1424	2.1311	2.1661	2.2040	2.2307	2.2586	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3527 (42)
Hot water usage for mixer showers													
Hot water usage for baths	60.1593	59.2552	57.9378	55.4171	53.5570	51.4825	50.3034	51.6109	53.0441	55.2714	57.8462	59.9288	(42a)
Hot water usage for other uses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Average daily hot water use (litres/day)	28.4833	27.4475	26.4118	25.3760	24.3402	23.3045	23.3045	24.3402	25.3760	26.4118	27.4475	28.4833	(42c)
	81.3587												(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	88.6425	86.7027	84.3495	80.7931	77.8972	74.7870	73.6079	75.9511	78.4201	81.6832	85.2937	88.4121	(44)
Energy content (annual)	140.3881	123.4635	129.6421	110.6018	104.8646	91.9594	89.0224	94.0433	96.6998	110.8433	121.5165	138.4319	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0582	18.5195	19.4463	16.5903	15.7297	13.7939	13.3534	14.1065	14.5050	16.6265	18.2275	20.7648	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
WWHRS	191.3470	169.4909	180.6010	159.9168	155.8235	141.2744	139.9813	145.0022	146.0149	161.8022	170.8316	189.3908	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	191.3470	169.4909	180.6010	159.9168	155.8235	141.2744	139.9813	145.0022	146.0149	161.8022	170.8316	189.3908	(64)
12Total per year (kWh/year)													
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													(64a)
Heat gains from water heating, kWh/month	59.4188	52.5585	55.8457	49.1039	47.6072	42.9053	42.3397	44.0091	44.4814	49.5951	52.7330	58.7683	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	58.7052	64.9950	58.7052	60.6620	58.7052	60.6620	58.7052	58.7052	60.6620	58.7052	60.6620	58.7052	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	116.3896	117.5974	114.5539	108.0746	99.8956	92.2086	87.0732	85.8654	88.9089	95.3882	103.5672	111.2542	(68)
Pumps, fans	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	(71)
Total internal gains	79.8640	78.2120	75.0615	68.1998	63.9882	59.5906	56.9082	59.1521	61.7798	66.6601	73.2403	78.9897	(72)
	301.2496	307.0953	294.6114	283.2273	268.8799	255.7521	245.9774	247.0136	254.6416	267.0444	283.7604	295.2400	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast				8.1100	11.2829		0.7200		0.7000	0.7700	31.9600 (75)
West				1.2500	19.6403		0.7200		0.7000	0.7700	8.5747 (80)
Solar gains	40.5348	81.8295	144.8338	232.7800	308.1214	326.3952	306.1731	247.0573	174.9498	99.4068	33.1516 (83)
Total gains	341.7844	388.9248	439.4452	516.0073	577.0014	582.1473	552.1505	494.0709	429.5914	366.4512	328.3916 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	46.3957	46.7047	47.0117	48.5091	48.7999	50.2009	50.2009	50.4693	49.6519	48.7999	48.2151	47.6186
alpha	4.0930	4.1136	4.1341	4.2339	4.2533	4.3467	4.3467	4.3646	4.3101	4.2533	4.2143	4.1746
util living area	0.9980	0.9963	0.9916	0.9714	0.9084	0.7646	0.6094	0.6839	0.9050	0.9852	0.9964	0.9984 (86)
MIT	19.0650	19.2482	19.5833	20.1035	20.5594	20.8686	20.9630	20.9404	20.6888	20.1161	19.5395	19.0796 (87)
Th 2	19.1297	19.1391	19.1484	19.1925	19.2008	19.2401	19.2401	19.2474	19.2249	19.2008	19.1840	19.1665 (88)
util rest of house	0.9969	0.9942	0.9863	0.9516	0.8418	0.6095	0.3847	0.4569	0.8036	0.9713	0.9939	0.9975 (89)
MIT 2	17.4763	17.6654	18.0044	18.5422	18.9550	19.2010	19.2363	19.2396	19.0923	18.5695	17.9883	17.5170 (90)
Living area fraction									fLA = Living area / (4) =			0.3911 (91)
MIT	18.0977	18.2845	18.6220	19.1529	19.5825	19.8533	19.9117	19.9048	19.7168	19.1745	18.5950	18.1282 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9477	18.1345	18.4720	19.0029	19.4325	19.7033	19.7617	19.7548	19.5668	19.0245	18.4450	17.9782 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9958	0.9925	0.9834	0.9487	0.8527	0.6564	0.4563	0.5302	0.8294	0.9692	0.9923	0.9965 (94)
Useful gains	340.3523	385.9948	432.1303	489.5502	492.0112	382.1489	251.9638	261.9421	356.3040	355.1762	332.0882	327.2554 (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	1200.3299	1156.2890	1039.1508	849.8486	646.5802	414.8158	256.9936	271.2454	449.2766	704.4378	960.1551	1180.6880 (97)
Space heating kWh	639.8234	517.6377	451.6232	259.4149	114.9993	0.0000	0.0000	0.0000	0.0000	259.8507	452.2081	634.9539 (98a)
Space heating requirement - total per year (kWh/year)												3330.5112
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	639.8234	517.6377	451.6232	259.4149	114.9993	0.0000	0.0000	0.0000	0.0000	259.8507	452.2081	634.9539 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3330.5112
Space heating per m2										(98c) / (4) =		87.7836 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												79.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	639.8234	517.6377	451.6232	259.4149	114.9993	0.0000	0.0000	0.0000	0.0000	259.8507	452.2081	634.9539 (98)
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000 (210)
Space heating fuel (main heating system)	728.9127	589.7138	514.5075	295.5359	131.0119	0.0000	0.0000	0.0000	0.0000	296.0324	515.1738	723.3652 (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)	63.9823	51.7638	45.1623	25.9415	11.4999	0.0000	0.0000	0.0000	0.0000	25.9851	45.2208	63.4954 (215)
Water heating												
Water heating requirement	191.3470	169.4909	180.6010	159.9168	155.8235	141.2744	139.9813	145.0022	146.0149	161.8022	170.8316	189.3908 (64)
Efficiency of water heater	81.5590	81.3945	81.0094	80.0930	78.3504	75.0000	75.0000	75.0000	75.0000	80.0708	81.1220	75.0000 (216)
Fuel for water heating, kWh/month	172.1308	151.6854	160.0333	138.0917	133.8405	122.6125	118.6965	125.3911	128.9331	138.4316	149.7948	169.7225 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	55.4858	50.1162	55.4858	53.6959	55.4858	53.6959	55.4858	55.4858	53.6959	55.4858	53.6959	55.4858 (231)

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Lighting	12.1978	9.7855	8.8108	6.4551	4.9861	4.0737	4.5485	5.9123	7.6796	10.0760	11.3808	12.5368 (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												3794.2532 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												333.0511 (215)
Efficiency of water heater												75.0000
Water heating fuel used												1709.3640 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
central heating pump												53.3000 (230c)
maintaining electric keep-hot facility for gas combi boiler												600.0000 (230f)
Total electricity for the above, kWh/year												653.3000 (231)
Electricity for lighting (calculated in Appendix L)												98.4431 (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												6588.4115 (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	3794.2532	0.2100	796.7932 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	333.0511	0.1548	51.5608 (263)
Water heating (other fuel)	1709.3640	0.2100	358.9664 (264)
Space and water heating			1207.3205 (265)
Pumps, fans and electric keep-hot	653.3000	0.1387	90.6208 (267)
Energy for lighting	98.4431	0.1443	14.2084 (268)
Total CO2, kg/year			1312.1496 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			34.5800 (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	3794.2532	1.1300	4287.5062 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	333.0511	1.5732	523.9470 (277)
Water heating (other fuel)	1709.3640	1.1300	1931.5814 (278)
Space and water heating			6743.0345 (279)
Pumps, fans and electric keep-hot	653.3000	1.5128	988.3122 (281)
Energy for lighting	98.4431	1.5338	150.9953 (282)
Total Primary energy kWh/year			7882.3420 (286)
Dwelling Primary energy Rate (DPER)			207.7600 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	17.2200 (1b)	x 2.8900 (2b)	= 49.7658 (1b) -

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First floor
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 37.9400 20.7200 (1c) x 2.6800 (2c) = 55.5296 (1c) -
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 105.2954 (5) (4)

2. Ventilation rate

m3 per hour

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

Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1899 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.4399 (18)
Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3410 (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	0.4347	0.4262	0.4177	0.3751	0.3665	0.3239	0.3239	0.3154	0.3410	0.3665	0.3836	0.4006 (22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802 (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)			9.3600	1.1450	10.7176		(27)
External Wall 1	15.1100	8.1100	7.0000	0.1800	1.2600		(29a)
Loft walls	64.4000		64.4000	0.1800	11.5920		(29a)
Dormer wall	1.5700	1.2500	0.3200	0.1800	0.0576		(29a)
Flat Ceiling	33.7700		33.7700	0.1100	3.7147		(30)
External Roof 2	1.4700		1.4700	0.1100	0.1617		(30)
Dormer	1.4700		1.4700	0.1100	0.1617		(30)
Total net area of external elements Aum(A, m2)			117.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.6653		(33)
Party Wall 1			66.9600	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							389.5387 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							5.8895 (36)
Point Thermal bridges							0.0000 (36a)
Total fabric heat loss						(33) + (36) + (36a) =	33.5548 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	20.6570	20.5295	20.4046	19.8176	19.7078	19.1965	19.1965	19.1018	19.3934	19.7078	19.9299	20.1622 (38)
Average = Sum(39)m / 12 =	54.2118	54.0843	53.9593	53.3723	53.2625	52.7513	52.7513	52.6566	52.9482	53.2625	53.4847	53.7169 (39)
												53.3718
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4289	1.4255	1.4222	1.4068	1.4039	1.3904	1.3904	1.3879	1.3956	1.4039	1.4097	1.4158 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3527 (42)
Hot water usage for mixer showers												
	60.1593	59.2552	57.9378	55.4171	53.5570	51.4825	50.3034	51.6109	53.0441	55.2714	57.8462	59.9288 (42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses												
	28.4833	27.4475	26.4118	25.3760	24.3402	23.3045	23.3045	24.3402	25.3760	26.4118	27.4475	28.4833 (42c)
Average daily hot water use (litres/day)												81.3587 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	88.6425	86.7027	84.3495	80.7931	77.8972	74.7870	73.6079	75.9511	78.4201	81.6832	85.2937	88.4121 (44)

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Energy content (annual)	140.3881	123.4635	129.6421	110.6018	104.8646	91.9594	89.0224	94.0433	96.6998	110.8433	121.5165	138.4319 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1351.4767
Water storage loss:	21.0582	18.5195	19.4463	16.5903	15.7297	13.7939	13.3534	14.1065	14.5050	16.6265	18.2275	20.7648 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	45.1713	39.9070	42.9836	39.8432	39.6956	36.8813	37.5098	38.7039	38.6729	41.6248	42.0626	45.0538 (61)
Total heat required for water heating calculated for each month	185.5594	163.3705	172.6257	150.4450	144.5602	128.8406	126.5322	132.7472	135.3727	152.4681	163.5791	183.4857 (62)
WWHRS	-27.5023	-24.3233	-25.4699	-21.0901	-19.6552	-16.8191	-15.7652	-16.7647	-17.4017	-20.5147	-23.2407	-26.9930 (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	158.0571	139.0472	147.1558	129.3549	124.9050	112.0215	110.7669	115.9824	117.9710	131.9534	140.3385	156.4927 (64)
										Total per year (kWh/year) = Sum(64)m =		1584.0465 (64)
12Total per year (kWh/year)												1584 (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	57.9719	51.0284	53.8519	46.7359	44.7914	39.7968	38.9774	40.9454	41.8209	47.2616	50.9199	57.2921 (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	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.7052	64.9950	58.7052	60.6620	58.7052	60.6620	58.7052	58.7052	60.6620	58.7052	60.6620	58.7052 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.3896	117.5974	114.5539	108.0746	99.8956	92.2086	87.0732	85.8654	88.9089	95.3882	103.5672	111.2542 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090 (71)
Water heating gains (Table 5)	77.9192	75.9351	72.3816	64.9110	60.2035	55.2733	52.3890	55.0341	58.0846	63.5236	70.7221	77.0055 (72)
Total internal gains	299.3049	304.8184	291.9315	279.9385	265.0952	251.4349	241.4582	242.8956	250.9464	263.9079	281.2421	293.2557 (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
Northeast				8.1100		11.2829		0.6300		0.7000		0.7700		27.9650 (75)
West				1.2500		19.6403		0.6300		0.7000		0.7700		7.5029 (80)
Solar gains	35.4679	71.6009	126.7296	203.6825	269.6063	285.5958	267.9014	216.1751	153.0811	86.9809	44.5425	29.0077	(83)	
Total gains	334.7728	376.4192	418.6611	483.6210	534.7015	537.0307	509.3597	459.0707	404.0275	350.8889	325.7846	322.2634	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	75.7272	75.9057	76.0815	76.9182	77.0768	77.8238	77.8238	77.9637	77.5344	77.0768	76.7567	76.4248
alpha	6.0485	6.0604	6.0721	6.1279	6.1385	6.1883	6.1883	6.1976	6.1690	6.1385	6.1171	6.0950
util living area	0.9985	0.9965	0.9894	0.9511	0.8250	0.6150	0.4538	0.5228	0.8137	0.9769	0.9964	0.9988 (86)
MIT	19.9186	20.0610	20.3022	20.6471	20.8970	20.9860	20.9981	20.9958	20.9304	20.5989	20.2050	19.8988 (87)
Th 2	19.7413	19.7438	19.7463	19.7582	19.7604	19.7707	19.7707	19.7726	19.7667	19.7604	19.7559	19.7512 (88)
util rest of house	0.9976	0.9946	0.9835	0.9246	0.7509	0.5041	0.3281	0.3862	0.7080	0.9590	0.9940	0.9981 (89)
MIT 2	18.5187	18.7023	19.0095	19.4357	19.6926	19.7657	19.7704	19.7719	19.7326	19.3913	18.8960	18.5010 (90)
Living area fraction									fLA = Living area / (4) =			0.3911 (91)
MIT	19.0663	19.2338	19.5151	19.9095	20.1637	20.2430	20.2506	20.2506	20.2012	19.8637	19.4080	19.0477 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0663	19.2338	19.5151	19.9095	20.1637	20.2430	20.2506	20.2506	20.2012	19.8637	19.4080	19.0477 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9935	0.9821	0.9285	0.7772	0.5478	0.3775	0.4401	0.7491	0.9609	0.9931	0.9976	(94)
Useful gains	333.7718	373.9749	411.1565	449.0464	415.5744	294.1831	192.2845	202.0435	302.6518	337.1797	323.5431	321.4954	(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	800.5054	775.2307	702.2874	587.6040	450.7994	297.6770	192.5760	202.7606	323.0450	493.4065	658.2897	797.5750	(97)
Space heating kWh	347.2498	269.6439	216.6014	99.7615	26.2074	0.0000	0.0000	0.0000	0.0000	116.2327	241.0175	354.2033	(98a)
Space heating requirement - total per year (kWh/year)												1670.9174	
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	347.2498	269.6439	216.6014	99.7615	26.2074	0.0000	0.0000	0.0000	0.0000	116.2327	241.0175	354.2033	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1670.9174	
Space heating per m2										(98c) / (4) =		44.0411	(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	347.2498	269.6439	216.6014	99.7615	26.2074	0.0000	0.0000	0.0000	0.0000	116.2327	241.0175	354.2033	(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)	375.8115	291.8224	234.4171	107.9670	28.3630	0.0000	0.0000	0.0000	0.0000	125.7930	260.8415	383.3369	(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	158.0571	139.0472	147.1558	129.3549	124.9050	112.0215	110.7669	115.9824	117.9710	131.9534	140.3385	156.4927	(64)
Efficiency of water heater	86.0184	85.7746	85.2083	83.8311	81.6702	80.3000	80.3000	80.3000	80.3000	84.1106	85.5291	86.0752	(216)
Fuel for water heating, kWh/month	183.7480	162.1078	172.7013	154.3042	152.9383	139.5038	137.9414	144.4364	146.9128	156.8808	164.0827	181.8094	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	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	12.1978	9.7855	8.8108	6.4551	4.9861	4.0737	4.5485	5.9123	7.6796	10.0760	11.3808	12.5368	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-18.3422	-26.1737	-38.1049	-43.4606	-47.4586	-44.5896	-44.1094	-41.3829	-36.6103	-30.2742	-20.3028	-15.8270	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-9.4336	-19.9432	-39.7933	-59.9644	-79.4383	-79.8030	-78.7951	-66.5902	-48.6899	-28.5077	-12.5979	-7.4469	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1808.3522	(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												1897.3667	(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)												98.4431	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-937.6398	(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												2952.5222	(238)

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1808.3522	0.2100	379.7540 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1897.3667	0.2100	398.4470 (264)
Space and water heating			778.2010 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	98.4431	0.1443	14.2084 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-406.6362	0.1343	-54.5981
PV Unit electricity exported	-531.0036	0.1258	-66.8113
Total			-121.4094 (269)
Total CO2, kg/year			682.9292 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			18.0000 (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	1808.3522	1.1300	2043.4380 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1897.3667	1.1300	2144.0244 (278)
Space and water heating			4187.4624 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	98.4431	1.5338	150.9953 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-406.6362	1.4962	-608.4140
PV Unit electricity exported	-531.0036	0.4618	-245.2428
Total			-853.6567 (283)
Total Primary energy kWh/year			3614.9017 (286)
Target Primary Energy Rate (TPER)			95.2800 (287)

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Property Reference	Studio Flat 9				Issued on Date	21/08/2023	
Assessment Reference	Proposed			Prop Type Ref	Existing 09		
Property							
SAP Rating	70 C		DER	7.59		TER	17.62
Environmental	96 A		% DER < TER				56.92
CO ₂ Emissions (t/year)	0.26		DFEE	78.62		TFEE	51.65
Compliance Check	See BREL		% DFEE < TFEE				-52.20
% DPER < TPER	16.16		DPER	78.18		TPER	93.25
Assessor Details	[REDACTED]				Assessor ID	V922-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	17.2200 (1b)	x 2.8900 (2b)	= 49.7658 (1b) -
First floor	20.7200 (1c)	x 2.6800 (2c)	= 55.5296 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	105.2954 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.1899 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4399 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3410 (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	0.4347	0.4262	0.4177	0.3751	0.3665	0.3239	0.3239	0.3154	0.3410	0.3665	0.3836	0.4006 (22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 (U _w = 1.40)			9.3600	1.3258	12.4091		(27)
External Wall 1	15.1100	8.1100	7.0000	0.1800	1.2600	17.0000	119.0000 (29a)
Loft walls	64.4000		64.4000	0.1800	11.5920	9.0000	579.6000 (29a)
Dormer wall	1.5700	1.2500	0.3200	0.1500	0.0480	9.0000	2.8800 (29a)
Flat Ceiling	33.7700		33.7700	0.1100	3.7147	9.0000	303.9300 (30)
External Roof 2	1.4700		1.4700	0.1500	0.2205	9.0000	13.2300 (30)
Dormer	1.4700		1.4700	0.1800	0.2646	9.0000	13.2300 (30)

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Total net area of external elements Aum(A, m2)	117.7900											(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	29.5089										(33)
Party Wall 1	66.9600	0.0000										(32)
Party Floor 1	35.2500											(32d)
Party Ceiling 1	8.9100											(32b)
Internal Wall 1	41.0700											(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14690.0000										(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												(35)
Thermal bridges (Default value 0.200 * total exposed area)												(36)
Point Thermal bridges												(36a) =
Total fabric heat loss	(33) + (36) + (36a) =	53.0669										(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	20.6570	20.5295	20.4046	19.8176	19.7078	19.1965	19.1965	19.1018	19.3934	19.7078	19.9299	20.1622 (38)
Average = Sum(39)m / 12 =	73.7239	73.5964	73.4714	72.8845	72.7746	72.2634	72.2634	72.1687	72.4603	72.7746	72.9968	73.2291 (39)
												72.8839
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.9432	1.9398	1.9365	1.9210	1.9182	1.9047	1.9047	1.9022	1.9099	1.9182	1.9240	1.9301 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3527 (42)
Hot water usage for mixer showers	60.1593	59.2552	57.9378	55.4171	53.5570	51.4825	50.3034	51.6109	53.0441	55.2714	57.8462	59.9288 (42a)	
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)	
Hot water usage for other uses	28.4833	27.4475	26.4118	25.3760	24.3402	23.3045	23.3045	24.3402	25.3760	26.4118	27.4475	28.4833 (42c)	
Average daily hot water use (litres/day)													81.3587 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	88.6425	86.7027	84.3495	80.7931	77.8972	74.7870	73.6079	75.9511	78.4201	81.6832	85.2937	88.4121 (44)	
Distribution loss (46)m = 0.15 x (45)m	140.3881	123.4635	129.6421	110.6018	104.8646	91.9594	89.0224	94.0433	96.6998	110.8433	121.5165	138.4319 (45)	
Water storage loss:	Total = Sum(45)m =											1351.4767	
Store volume	21.0582	18.5195	19.4463	16.5903	15.7297	13.7939	13.3534	14.1065	14.5050	16.6265	18.2275	20.7648 (46)	
b) If manufacturer declared loss factor is not known :												110.0000 (47)	
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)	
Volume factor from Table 2a												1.0294 (52)	
Temperature factor from Table 2b												0.6000 (53)	
Enter (49) or (54) in (55)												1.0327 (55)	
Total storage loss	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (56)	
If cylinder contains dedicated solar storage	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144 (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	195.6649	173.3909	184.9189	164.0955	160.1414	145.4531	144.2992	149.3201	150.1935	166.1201	175.0102	193.7087 (62)	
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	195.6649	173.3909	184.9189	164.0955	160.1414	145.4531	144.2992	149.3201	150.1935	166.1201	175.0102	193.7087 (64)	
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2002.3165 (64)	
Electric shower(s)												2002 (64)	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)	
Heat gains from water heating, kWh/month	90.9005	80.9936	87.3274	79.5700	79.0889	73.3714	73.8214	75.4909	74.9476	81.0768	83.1992	90.2501 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	58.7052	64.9950	58.7052	60.6620	58.7052	60.6620	58.7052	58.7052	60.6620	58.7052	60.6620	58.7052	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	116.3896	117.5974	114.5539	108.0746	99.8956	92.2086	87.0732	85.8654	88.9089	95.3882	103.5672	111.2542	(68)
Pumps, fans	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	(71)
	122.1781	120.5261	117.3756	110.5139	106.3023	101.9048	99.2223	101.4662	104.0939	108.9742	115.5544	121.3038	(72)

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Total internal gains
340.5638 346.4094 333.9255 322.5414 308.1940 298.0663 288.2915 289.3277 296.9558 306.3585 323.0745 334.5541 (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
Northeast				8.1100	11.2829	0.7200		0.7000		0.7700		31.9600 (75)
West				1.2500	19.6403	0.7200		0.7000		0.7700		8.5747 (80)
Solar gains	40.5348	81.8295	144.8338	232.7800	308.1214	326.3952	306.1731	247.0573	174.9498	99.4068	50.9057	33.1516 (83)
Total gains	381.0985	428.2390	478.7593	555.3215	616.3155	624.4615	594.4646	536.3850	471.9056	405.7653	373.9801	367.7057 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	55.3491	55.4450	55.5393	55.9866	56.0711	56.4678	56.4678	56.5419	56.3143	56.0711	55.9005	55.7232
alpha	4.6899	4.6963	4.7026	4.7324	4.7381	4.7645	4.7645	4.7695	4.7543	4.7381	4.7267	4.7149
util living area	0.9972	0.9946	0.9871	0.9554	0.8620	0.6848	0.5219	0.5934	0.8492	0.9751	0.9943	0.9976 (86)
MIT	19.4762	19.6408	19.9380	20.3694	20.7387	20.9373	20.9861	20.9754	20.8217	20.3515	19.8467	19.4520 (87)
Th 2	19.3715	19.3738	19.3760	19.3865	19.3885	19.3976	19.3976	19.3993	19.3941	19.3885	19.3845	19.3803 (88)
util rest of house	0.9956	0.9917	0.9795	0.9282	0.7836	0.5397	0.3388	0.4004	0.7313	0.9543	0.9906	0.9964 (89)
MIT 2	17.6907	17.9018	18.2792	18.8134	19.2120	19.3753	19.3958	19.3954	19.3053	18.8071	18.1729	17.6657 (90)
Living area fraction	18.3891	18.5820	18.9281	19.4220	19.8092	19.9863	20.0179	20.0134	19.8984	19.4112	18.8276	18.3644 (92)
MIT	18.3891	18.5820	18.9281	19.4220	19.8092	19.9863	20.0179	20.0134	19.8984	19.4112	18.8276	18.3644 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3891	18.5820	18.9281	19.4220	19.8092	19.9863	20.0179	20.0134	19.8984	19.4112	18.8276	18.3644 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9942	0.9896	0.9766	0.9290	0.8073	0.5969	0.4118	0.4780	0.7750	0.9547	0.9887	0.9951 (94)
Useful gains	378.9022	423.7655	467.5425	515.8675	497.5749	372.7312	244.7748	256.4081	365.7441	387.3926	369.7413	365.9149 (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	1038.7032	1006.9437	913.1075	766.8891	590.1412	389.2316	246.9868	260.7739	420.1564	641.2313	856.0775	1037.2475 (97)
Space heating kWh	490.8920	391.8958	331.5003	180.7356	68.8693	0.0000	0.0000	0.0000	0.0000	188.8560	350.1620	499.4715 (98a)
Space heating requirement - total per year (kWh/year)												2502.3825
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	490.8920	391.8958	331.5003	180.7356	68.8693	0.0000	0.0000	0.0000	0.0000	188.8560	350.1620	499.4715 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2502.3825
Space heating per m2										(98c) / (4) =		65.9563 (99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (301)
Fraction of space heat from community system												0.9000 (302)
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system												1.5000 (306)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating:												
Space heating requirement	490.8920	391.8958	331.5003	180.7356	68.8693	0.0000	0.0000	0.0000	0.0000	188.8560	350.1620	499.4715 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.50												
307a	662.7042	529.0593	447.5254	243.9930	92.9736	0.0000	0.0000	0.0000	0.0000	254.9557	472.7187	674.2865
Space heating requirement	662.7042	529.0593	447.5254	243.9930	92.9736	0.0000	0.0000	0.0000	0.0000	254.9557	472.7187	674.2865 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												100.0000 (308)
Space heating fuel for secondary/supplementary system	49.0892	39.1896	33.1500	18.0736	6.8869	0.0000	0.0000	0.0000	0.0000	18.8856	35.0162	49.9471 (309)
Water heating:												
Annual water heating requirement	195.6649	173.3909	184.9189	164.0955	160.1414	145.4531	144.2992	149.3201	150.1935	166.1201	175.0102	193.7087 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.50												
310a	293.4974	260.0864	277.3784	246.1432	240.2122	218.1796	216.4488	223.9802	225.2902	249.1801	262.5153	290.5631
Water heating fuel												

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	293.4974	260.0864	277.3784	246.1432	240.2122	218.1796	216.4488	223.9802	225.2902	249.1801	262.5153	290.5631 (310)
Cooling System Energy Efficiency Ratio												0.0000 (314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)
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 (331)
Lighting	12.1978	9.7855	8.8108	6.4551	4.9861	4.0737	4.5485	5.9123	7.6796	10.0760	11.3808	12.5368 (332)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333a)m	-15.7441	-22.5334	-32.4118	-36.1866	-38.6140	-35.4888	-35.1351	-32.9890	-29.3710	-25.4644	-17.3885	-13.6185 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)												
(333b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(334b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(335b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year												
Space heating fuel - community heating												3378.2163 (307)
Space heating fuel - secondary												250.2382 (309)
Water heating fuel - community heating												3003.4748 (310)
Efficiency of water heater												0.0000 (311)
Electricity used for heat distribution												33.7822 (313)
Space cooling fuel												0.0000 (321)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (331)
Electricity for lighting (calculated in Appendix L)												98.4431 (332)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-334.9453 (333)
Wind generation												0.0000 (334)
Hydro-electric generation (Appendix N)												0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (335)
Appendix Q - special features												
Energy saved or generated												-0.0000 (336)
Energy used												0.0000 (337)
Total delivered energy for all uses												6395.4271 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			350.0000 (367)
Space and Water heating from Heat pump	1823.3403	0.1552	149.7910 (367)
Electrical energy for heat distribution (space & water)	33.7822	0.0000	9.4674 (372)
Overall CO2 factor for heat network			0.0439 (386)
Total CO2 associated with community systems			279.9634 (373)
Space heating - secondary	250.2382	0.1552	38.8347 (374)
Space and water heating			318.7981 (376)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (378)
Energy for lighting	98.4431	0.1443	14.2084 (379)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-334.9453	0.1348	-45.1477
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-45.1477 (380)
Total CO2, kg/year			287.8588 (383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.5900 (384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Efficiency of heat source Heat pump			350.0000 (467a)
Space and Water heating from Heat pump	1823.3403	1.5746	1519.7797 (467)
Electrical energy for heat distribution (space & water)	33.7822	0.0000	98.8480 (472)
Overall CO2 factor for heat network			0.4580 (486)
Total CO2 associated with community systems			2923.0769 (473)
Space heating - secondary	250.2382	1.5746	394.0170 (374)
Space and water heating			3317.0939 (476)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (478)
Energy for lighting	98.4431	1.5338	150.9953 (479)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-334.9453	1.4982	-501.8098
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-501.8098 (480)
Total Primary energy kWh/year			2966.2794 (483)
Dwelling Primary energy Rate (DPER)			78.1800 (484)

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CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	17.2200 (1b)	x 2.8900 (2b)	= 49.7658 (1b) -
First floor	20.7200 (1c)	x 2.6800 (2c)	= 55.5296 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 105.2954 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1899 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4399 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3410 (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	0.4347	0.4262	0.4177	0.3751	0.3665	0.3239	0.3239	0.3154	0.3410	0.3665	0.3836	0.4006 (22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (U _w = 1.20)			9.3600	1.1450	10.7176		(27)
External Wall 1	15.1100	8.1100	7.0000	0.1800	1.2600		(29a)
Loft walls	64.4000		64.4000	0.1800	11.5920		(29a)
Dormer wall	1.5700	1.2500	0.3200	0.1800	0.0576		(29a)
Flat Ceiling	33.7700		33.7700	0.1100	3.7147		(30)
External Roof 2	1.4700		1.4700	0.1100	0.1617		(30)
Dormer	1.4700		1.4700	0.1100	0.1617		(30)
Total net area of external elements A _{um} (A, m ²)			117.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.6653		(33)
Party Wall 1			66.9600	0.0000	0.0000		(32)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							389.5387 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							5.8895 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	33.5548 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	20.6570	20.5295	20.4046	19.8176	19.7078	19.1965	19.1965	19.1018	19.3934	19.7078	19.9299	20.1622 (38)
Average = Sum(39)m / 12 =	54.2118	54.0843	53.9593	53.3723	53.2625	52.7513	52.7513	52.6566	52.9482	53.2625	53.4847	53.7169 (39)
												53.3718
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4289	1.4255	1.4222	1.4068	1.4039	1.3904	1.3904	1.3879	1.3956	1.4039	1.4097	1.4158 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

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Assumed occupancy												1.3527 (42)
Hot water usage for mixer showers	60.1593	59.2552	57.9378	55.4171	53.5570	51.4825	50.3034	51.6109	53.0441	55.2714	57.8462	59.9288 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	28.4833	27.4475	26.4118	25.3760	24.3402	23.3045	23.3045	24.3402	25.3760	26.4118	27.4475	28.4833 (42c)
Average daily hot water use (litres/day)												81.3587 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.6425	86.7027	84.3495	80.7931	77.8972	74.7870	73.6079	75.9511	78.4201	81.6832	85.2937	88.4121 (44)
Energy content (annual)	140.3881	123.4635	129.6421	110.6018	104.8646	91.9594	89.0224	94.0433	96.6998	110.8433	121.5165	138.4319 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0582	18.5195	19.4463	16.5903	15.7297	13.7939	13.3534	14.1065	14.5050	16.6265	18.2275	20.7648 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	186.9830	165.5492	176.2370	155.6936	151.4595	137.0512	135.6173	140.6382	141.7916	157.4382	166.6083	185.0268 (62)
WWHRS	-27.5023	-24.3233	-25.4699	-21.0901	-19.6552	-16.8191	-15.7652	-16.7647	-17.4017	-20.5147	-23.2407	-26.9930 (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	159.4807	141.2260	150.7671	134.6035	131.8043	120.2321	119.8521	123.8735	124.3899	136.9235	143.3677	158.0338 (64)
12Total per year (kWh/year)												1644.5541 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	83.9550	74.7202	80.3819	72.8486	72.1434	66.6500	66.8759	68.5453	68.2262	74.1313	76.4777	83.3045 (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	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363	67.6363 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.7052	64.9950	58.7052	60.6620	58.7052	60.6620	58.7052	58.7052	60.6620	58.7052	60.6620	58.7052 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.3896	117.5974	114.5539	108.0746	99.8956	92.2086	87.0732	85.8654	88.9089	95.3882	103.5672	111.2542 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636	29.7636 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090	-54.1090 (71)
Water heating gains (Table 5)	112.8427	111.1908	108.0402	101.1786	96.9670	92.5694	89.8869	92.1308	94.7585	99.6389	106.2190	111.9685 (72)
Total internal gains	334.2284	340.0741	327.5902	316.2061	301.8587	288.7309	278.9562	279.9923	287.6204	300.0231	316.7391	328.2187 (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
Northeast				8.1100		11.2829		0.6300		0.7000		0.7700		27.9650 (75)
West				1.2500		19.6403		0.6300		0.7000		0.7700		7.5029 (80)
Solar gains	35.4679	71.6009	126.7296	203.6825	269.6063	285.5958	267.9014	216.1751	153.0811	86.9809	44.5425	29.0077	(83)	
Total gains	369.6963	411.6749	454.3197	519.8886	571.4649	574.3267	546.8576	496.1674	440.7015	387.0041	361.2816	357.2264	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n1,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	75.7272	75.9057	76.0815	76.9182	77.0768	77.8238	77.8238	77.9637	77.5344	77.0768	76.7567	76.4248
alpha	6.0485	6.0604	6.0721	6.1279	6.1385	6.1883	6.1883	6.1976	6.1690	6.1385	6.1171	6.0950
util living area	0.9974	0.9943	0.9842	0.9344	0.7917	0.5786	0.4232	0.4852	0.7687	0.9639	0.9937	0.9979 (86)

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MIT	19.9838	20.1259	20.3646	20.6962	20.9185	20.9899	20.9987	20.9972	20.9495	20.6564	20.2703	19.9644 (87)
Th 2	19.7413	19.7438	19.7463	19.7582	19.7604	19.7707	19.7707	19.7726	19.7667	19.7604	19.7559	19.7512 (88)
util rest of house	0.9960	0.9914	0.9758	0.9018	0.7141	0.4724	0.3057	0.3575	0.6592	0.9383	0.9899	0.9968 (89)
MIT 2	18.6019	18.7844	19.0862	19.4885	19.7087	19.7672	19.7705	19.7722	19.7434	19.4563	18.9783	18.5847 (90)
Living area fraction									fLA = Living area / (4) =			0.3911 (91)
MIT	19.1424	19.3091	19.5862	19.9609	20.1819	20.2455	20.2509	20.2513	20.2152	19.9257	19.4836	19.1244 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1424	19.3091	19.5862	19.9609	20.1819	20.2455	20.2509	20.2513	20.2152	19.9257	19.4836	19.1244 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9951	0.9900	0.9744	0.9081	0.7424	0.5142	0.3518	0.4078	0.7020	0.9426	0.9887	0.9960 (94)	
Useful gains	367.8783	407.5688	442.6715	472.0941	424.2744	295.3199	192.3956	202.3285	309.3823	364.7920	357.1980	355.7861 (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	804.6351	779.3061	706.1236	590.3444	451.7676	297.8049	192.5913	202.7977	323.7874	496.7088	662.3352	801.6921 (97)	
Space heating kWh	324.9471	249.8074	196.0084	85.1402	20.4550	0.0000	0.0000	0.0000	0.0000	98.1461	219.6988	331.7540 (98a)	
Space heating requirement - total per year (kWh/year)												1525.9569	
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	324.9471	249.8074	196.0084	85.1402	20.4550	0.0000	0.0000	0.0000	0.0000	98.1461	219.6988	331.7540 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1525.9569	
Space heating per m2										(98c) / (4) =			40.2203 (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	324.9471	249.8074	196.0084	85.1402	20.4550	0.0000	0.0000	0.0000	0.0000	98.1461	219.6988	331.7540 (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)	352.0553	270.6473	212.3601	92.2429	22.1614	0.0000	0.0000	0.0000	0.0000	106.3338	238.0269	359.4302 (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	159.4807	141.2260	150.7671	134.6035	131.8043	120.2321	119.8521	123.8735	124.3899	136.9235	143.3677	158.0338 (64)	
Efficiency of water heater	85.6209	85.3245	84.6493	83.0617	80.9015	79.8000	79.8000	79.8000	79.8000	83.3260	85.0139	79.8000 (216)	
Fuel for water heating, kWh/month	186.2637	165.5163	178.1079	162.0524	162.9194	150.6668	150.1905	155.2299	155.8771	164.3226	168.6403	184.4422 (219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	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	12.1978	9.7855	8.8108	6.4551	4.9861	4.0737	4.5485	5.9123	7.6796	10.0760	11.3808	12.5368 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-18.3422	-26.1737	-38.1049	-43.4606	-47.4586	-44.5896	-44.1094	-41.3829	-36.6103	-30.2742	-20.3028	-15.8270 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	-9.4336	-19.9432	-39.7933	-59.9644	-79.4383	-79.8030	-78.7951	-66.5902	-48.6899	-28.5077	-12.5979	-7.4469 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1												1653.2578 (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												1984.2291 (219)	
Space cooling fuel												0.0000 (221)	
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000 (231)	

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Electricity for lighting (calculated in Appendix L)	98.4431 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-937.6398 (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	2884.2901 (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	1653.2578	0.2100	347.1841 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1984.2291	0.2100	416.6881 (264)
Space and water heating			763.8722 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	98.4431	0.1443	14.2084 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-406.6362	0.1343	-54.5981
PV Unit electricity exported	-531.0036	0.1258	-66.8113
Total			-121.4094 (269)
Total CO2, kg/year			668.6005 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			17.6200 (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	1653.2578	1.1300	1868.1813 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1984.2291	1.1300	2242.1788 (278)
Space and water heating			4110.3601 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	98.4431	1.5338	150.9953 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-406.6362	1.4962	-608.4140
PV Unit electricity exported	-531.0036	0.4618	-245.2428
Total			-853.6567 (283)
Total Primary energy kWh/year			3537.7995 (286)
Target Primary Energy Rate (TPER)			93.2500 (287)

Project name

72 Gloucester Road Proposed**As built**

Date: Mon Aug 21 07:46:09 2023

Administrative information

Building Details

Address: 72 Gloucester Road Proposed,

Certifier details

Name: [REDACTED]

Telephone number: [REDACTED]

Address: Unit 46 Easton Business Centre, Felix Road,
Bristol, BS5 0HE

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.d.0

Interface to calculation engine: iSBEM

Interface to calculation engine version: v6.1.d

BRUKL compliance module version: v6.1.d.0

Foundation area [m²]: 129The CO₂ 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	3.58
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	6.16
Target primary energy rate (TPER), kWh/m ² annum	38.46
Building primary energy rate (BPER), kWh/m ² annum	65.15
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-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	1.52	1.83	Z01/01/e
Floors	0.18	0.2	0.2	Z01/01/f
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	-	-	No heat loss flat roofs
Windows** and roof windows	1.6	2.94	2.94	Z01/01/e/g
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-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* 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/m²K

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- Central Heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	0.4	-
Standard value	2.5*	N/A	N/A	1.9^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- Default HWS

	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
Z02/01	125	-	-
Z01/01	125	90	1.667

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?
Z01/01	YES (+35.6%)	NO

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]	129	129
External area [m ²]	210.2	210.2
Weather	CAR	CAR
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	181.73	66.73
Average U-value [W/m ² K]	0.86	0.32
Alpha value* [%]	7.33	18.16

* 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/m²]

	Actual	Notional
Heating	15.85	2.8
Cooling	0	0
Auxiliary	10.66	8.27
Lighting	14.27	15.44
Hot water	1.6	1.6
Equipment*	19.09	19.09
TOTAL **	42.38	28.1

* 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/m²]

	Actual	Notional
Photovoltaic systems	0	2.19
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>2.19</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	284.67	114.82
Primary energy [kWh/m ²]	65.15	38.46
Total emissions [kg/m ²]	6.16	3.58

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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	208.9	1.7	0	0	0	0	0	0	0
Notional	81.7	15	0	0	0	0	0	----	----
[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	196.3	92.9	16.8	0	11.3	3.24	0	4	0
Notional	28.2	87.7	3	0	8.8	2.64	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

Project name

72 Gloucester Road Baseline**As built****Date:** Mon Aug 21 07:41:01 2023

Administrative information

Building Details

Address: 72 Gloucester Road Baseline,

Certifier details

Name: [REDACTED]**Telephone number:** [REDACTED]**Address:** Unit 46 Easton Business Centre, Felix Road,
Bristol, BS5 0HE

Certification tool

Calculation engine: SBEM**Calculation engine version:** v6.1.d.0**Interface to calculation engine:** iSBEM**Interface to calculation engine version:** v6.1.d**BRUKL compliance module version:** v6.1.d.0**Foundation area [m²]:** 129The CO₂ 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	2.53
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	17.87
Target primary energy rate (TPER), kWh/m ² annum	0
Building primary energy rate (BPER), kWh/m ² annum	109.75
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-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	1.52	1.83	Z01/01/e
Floors	0.18	0.2	0.2	Z01/01/f
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	-	-	No heat loss flat roofs
Windows** and roof windows	1.6	2.94	2.94	Z01/01/e/g
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-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* 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/m²K

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- Rads

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.82	-	-	-	-
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- Default HWS

	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
Z02/01		125	-	-
Z01/01		125	90	1.667

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?
Z01/01	YES (+35.6%)	NO

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]	129	129
External area [m ²]	210.2	210.2
Weather	CAR	CAR
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	181.73	66.73
Average U-value [W/m ² K]	0.86	0.32
Alpha value* [%]	7.33	18.16

* 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/m²]

	Actual	Notional
Heating	73.03	22.37
Cooling	0	0
Auxiliary	2.27	1.08
Lighting	14.27	15.44
Hot water	1.6	1.6
Equipment*	19.09	19.09
TOTAL**	91.17	40.49

* 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/m²]

	Actual	Notional
Photovoltaic systems	0	35.68
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>35.68</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	292.15	156.64
Primary energy [kWh/m ²]	109.75	-0.74
Total emissions [kg/m ²]	17.87	2.53

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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	208.9	1.7	0	0	0	0	0	0	0
Notional	81.7	15	0	0	0	0	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	204.2	92.9	77.5	0	2.4	0.73	0	0.82	0
Notional	73.5	86.8	23.7	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



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