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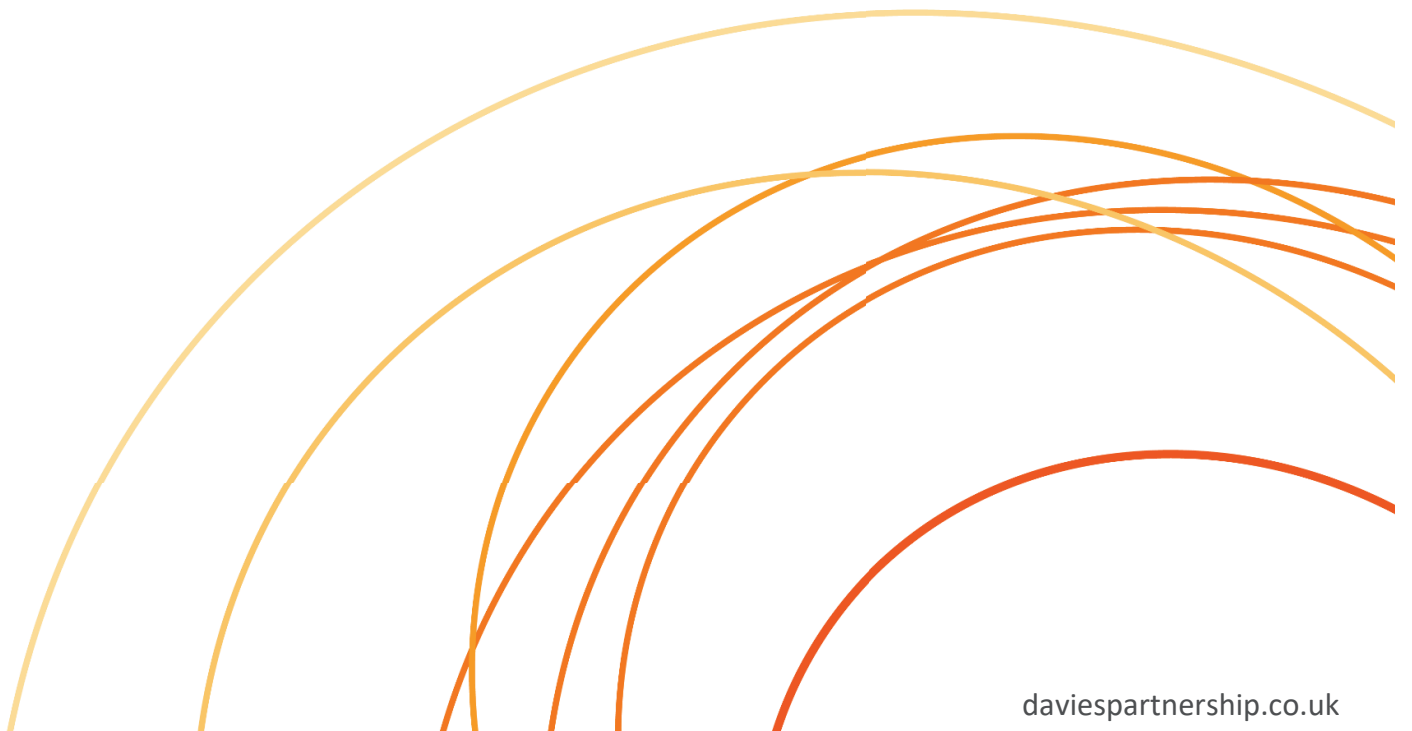
Energy Strategy Statement

PROJECT:

Queens Drive, Rochdale

CLIENT:

MSV Housing



DOCUMENT CONTROL

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1.0 Executive Summary

Davies Partnership has been appointed to develop an Energy Strategy Statement for the proposed Apartment block and housing development at Queens Drive, Rochdale

The purpose of the statement is to set out the overall structure and servicing options for the development as it moves forward through the various stages of design. It should be read in context with all other planning documents forming the outline planning application.

This statement provides an initial indication of what the potential carbon savings could be for the development. Preliminary 'SAP' assessments have been undertaken to consider dwelling performance in line with local authority requirements and Building Regulation Part L. It is anticipated that during the design and construction stages of the development that; the statutory requirements, range of technical solutions, and/or their cost effectiveness may change. Therefore, further 'detailed' assessments will be carried out to take account of any changes to ensure optimal performance.

1.1 Site & Development Description

The proposal is to create 28 highly insulated and energy efficient dwellings on the site of a former 'temporary' medical practice. The proposal consists of the removal of the now unused single storey modular building and the construction of a 3-storey apartment block alongside matching 3-storey town houses with associated car parking and communal green space.

- 23 x 1-bedroom apartments (1B2P)
- 5 x 4-bedroom houses (4B7P)



1.2 Development Appraisal

The proposed development has been reviewed, and the scheme can be constructed and serviced sustainably to ensure that the local authority's aspirations are met.

- Table 1 summarizes the fabric standards required
- Tables 3, 4, 5 & 6 summarize the M&E servicing strategies & Renewables proposed

During the detail design period the proposal will be refined, and further SAP and DSM analysis will be undertaken to ensure optimal design decisions are made and that energy performance is maintained.

2.0 Introduction

The UK government has written into law that new buildings/dwellings will need to be net zero carbon by 2050. To achieve this, construction and servicing methods will need to evolve, and innovative solutions created to support individual, communal, local, and national developments. Local councils have declared climate emergencies having seen the scale of the task ahead. Rochdale Borough Council has been at the forefront of climate action since 2019 and have ambitious plans to be carbon neutral by 2038 in line with the Greater Manchester Combined Authority (GMCA) and as such have adopted the 'Places for Everyone (PfE)' and 'Truly Affordable Net Zero (TANZ)' core principles for sustainable design.

This energy statement seeks to demonstrate that the proposed development has considered the implications it will have on the area and that its design intent is aligned with Rochdale Borough Councils aspiration to deliver sustainable developments. The environmental and energy strategy for this development has been generated in accordance with the following regulations and planning policies:

2.1 Building Regulations

Building Regulation Approved Document Part L (Volume 1: Dwellings Conservation of Fuel and Power) – 2021 edition came into effect on the 15th of June 2022 and outlines the minimum fabric and servicing standards along with the carbon emission saving requirements for new developments. A revised Part L (2025) future homes standard is currently in consultation and is expected within 2025-26.

2.2 National Planning Policy Framework 2025

The NPPF was updated in February 2025 and promotes an emphasis on meeting community needs, beauty, place-making, the environment, and sustainable development. The environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to support energy efficiency and low carbon heating systems.

2.3 Rochdale Borough Council Local Planning framework

In March 2024, the Places for Everyone (PfE) joint development plan prepared by GMCA came in to force and became a statutory requirement for new developments, with climate change a key driver and the following policies were introduced:

Policy JP-S2 'Carbon and Energy' which states that developments should target:

- Net Zero Carbon performance where feasible
 - From adoption to regulated operational carbon emissions
 - From 2028 to all emissions in construction
- As an interim measure, developments should be consistent with 2021 Part L building regulations and from 2025, developments should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions.

Policy JP-S3 'Heat and Energy Networks' which refers to the delivery of low carbon heating.

In 2021 a Net Zero commitment was made by the GMCA to support the building of 30,000 Net Zero social rented homes across the region by 2038. As a consequence, the proposed TANZ (Truly Affordable Net Zero standard) was adopted in 2023 and refined in August 2025. The TANZ standard applies to any new build social housing delivered by local authorities or other housing providers in Greater Manchester.



The energy efficiency benchmark targets for new developments are:

Percentage Improvement Benchmark		
Building Type	Apartment	House
Form Factor	≤ 2	≤ 2
Fossil Fuel Free	Yes	Yes
Space Heating	15kWh/m ²	20kWh/m ²
Hot Water Demand	20% Reduction	20% Reduction
Renewable Energy (size of PV array)	40% of ground floor area	40% of ground floor area
Energy Use Intensity	35kWh/m ² /yr	35kWh/m ² /yr
Part O Compliant	Avoid comfort cooling	Avoid comfort cooling
Embodied Carbon	$\leq 600\text{kgCO}_2/\text{m}^2$	$\leq 500\text{kgCO}_2/\text{m}^2$

The scheme has therefore been reviewed against these requirements to ensure optimal performance.

3.0 Route to Compliance - Dwelling Design

3.1 Energy Hierarchy

This development follows the principles of the energy hierarchy to minimise energy use and carbon emissions. There are 3 main ways of ensuring an energy efficient building, passive, active and renewable:



Passive

Passive design refers to a design approach that uses the buildings orientation, construction, and design to minimise the amount of energy required to condition its internal environment by maximising the effects of natural elements, such as the sun and wind. Good passive design should require very little maintenance and reduce a building's energy consumption by minimising or eliminating the mechanical systems used to regulate indoor temperature and ventilation as well as lighting.

Passive design takes advantage of the sun's limitless energy by maximising the solar heat gain and natural day light entering a building, through optimal glazing orientation and location. While good levels of insulation assist in minimising heat losses, and the use of appropriately sized and positioned operable windows can provide natural ventilation.

Building size, positioning, construction & glazing specifications have been considered.

Active

Active design refers to a design approach that maximizes the efficiencies of both the fixed mechanical and electrical building services, such as boilers, chillers, air conditioners and light fittings, as well as the efficiencies of the "loose" equipment installed for the building's operation, such as fridges, freezers, IT equipment. Good active design incorporates optimally scheduled and coordinated preventative maintenance to ensure that the equipment operates at its optimal efficiency all the time.

Active design takes advantage of the increasing system efficiencies commercially available for mechanical and electrical services and systems. This along with good design practices of optimally sizing and selecting equipment means energy usage will be reduced.

Energy efficient heating, hot water and ventilation systems have been considered.

Renewable

Renewable integration is a way of designing and operating a building and its services to efficiently utilise environmentally friendly, naturally occurring inexhaustible energy acquired locally. Renewable technologies using appropriate equipment can harvest energy from the sun, the wind, flowing water or from biofuels.

Appropriate renewable technologies have been considered.

3.2 Residential Standards

A fabric first 'Passive / Lean' approach has been taken, and enhanced building fabrics are proposed which improve upon the minimum U-value standards required for compliance with Building Regulation Part L as out lined in Table 1:

Construction Standards

Table 1: Fabric Performance

Element	Construction U-values			
	Regulatory	Notional 'Target'	Design	Design 'Betterment'
U-values (W/m ² .K)				
Ground Floor	0.18	0.13	0.12	33.3%
External Walls	0.26	0.18	0.15	42%
Party Walls	0.2	0.0	0.0	100%
Roof	0.16	0.11	0.11	31.25%
Windows	1.6	1.2	1.0	37.5%
Glazed Doors	1.6	1.2	1.0	37.5%
Solid Doors	1.6	1.0	1.2	25%
Thermal Bridging	0.2	Bespoke Construction Detailing	Bespoke Construction Detailing (0.07)	65%
Air Permeability	8@50Pa	5@50Pa	3@50Pa	62.5%

To minimise the buildings impact on climate change, high global warming potential (GWP) and nitrogen oxide (NOx) gas emissions into the atmosphere will be reduced as much as possible with insulating materials being specified that have a GWP of less than 5.

External opaque construction U-values will be achieved via the use of appropriate insulation types and thicknesses, with high performing glazing used throughout and all internal party walls between dwellings and heated communal areas will be fully filled and edge sealed, to reduce dwelling heat losses as much as is practically possible.

As U-values improve and direct heat losses reduce, point heat losses via thermal bridging junctions become ever more important, and these will need to be reviewed, detailed, calculated and photographed as required to assist building performance, air permeability, and compliance as the project progresses.

Overheating Risk

Highly insulated dwellings can suffer from overheating, due to increased heat retention, internal heat gains, solar gains, and low ventilation rates. To avoid or reduce this risk, it is necessary to make use of a suite of passive measures to reduce heat gains within occupied spaces and then, to manage them and ventilation rates, to maintain comfort conditions. Approved document Part O came into force in June 2022 to ensure that overheating risk is reviewed and minimised. Therefore, the measures described in Table 2, have been considered and applied to each dwelling and will be reviewed during the detailed design stage to ensure overheating is minimised.

Table 2: Mitigating measures for overheating	
Cooling Hierarchy	Design
Minimise internal heat generation.	Energy efficient lighting to be proposed to all dwellings. Daylighting levels to be optimised to reduce artificial lighting requirements during the day. Low energy appliances should be used. Pipework and water storage cylinders to be insulated to minimise heat gains. Mechanical extract ventilation in kitchens to extract heat from source to outside.
Reduce solar gains in summer through orientation, shading, albedo, fenestration, and insulation.	Overhangs, reveals and balconies reduce solar gains when the sun is high in the sky, but can allow solar gains during winter months when the sun is lower (well suited to south facing façade's). Larger areas of glazing are typically in the form of opening doors providing access to balconies or set-back terraces with overhangs. Solar gains through windows can be reduced through solar control glazing, but this should be carefully considered as it also limits useful heat gains in winter. All dwellings will be highly insulated, reducing heat gains from conduction of external surfaces and warmer external temperatures. Movable external shading panels should also be considered where possible. These have a twofold benefit in that, when they are drawn in the summer months, solar gains are reduced, and when open in winter months beneficial solar gains can be received.
Passive Ventilation.	High levels of natural ventilation can be effective in reducing heat buildup, while providing occupier control. Appropriate operable windows and cross ventilation will be utilised where possible. Where only single sided ventilation is possible the ventilation is driven by temperature differential, and for this form of ventilation a difference in height across the window opening is required (high & low openings). Considerations for natural ventilation include air quality, noise, and security. To limit security concerns, openable windows may be restricted and should be lockable in position or derestricted as required.
Enhanced Natural Ventilation via extraction.	During times when the natural ventilation through limited openings is not sufficient an additional extract fan can be used to drive higher volumes of air through the window opening. This is the preferred option to achieve the additional ventilation rates required. This option extracts air from areas located further away from windows and ensures a higher natural ventilation rate is achieved even when passive driving forces are not sufficient, such as low wind pressure. This system has the potential added benefit of being controlled such that it only operates when external temperatures are lower than internal temperatures.
Mechanical Ventilation.	Mechanical ventilation will be provided as standard to comply with Building Regulation Part F as a minimum requirement. MVHR units will have a summer bypass option to reduce incoming air temperatures. In addition, the units should be able to operate at a boost mode continuously to provide an enhanced level of mechanical ventilation without exceeding noise and specific fan power limits.
Active Cooling.	Where a combination of the above measures is not sufficient to mitigate the overheating risk the provision of comfort cooling may be required.

The carefully considered fabric standards proposed lowers each dwellings heating demand which in conjunction with the energy efficient M&E servicing proposed and outlined in Tables 3 & 4, further minimises the energy required in the use of these dwellings. All of the proposed M&E systems are compliant with Part L of the Building Regulations (2021) and exceed the minimum performance standards required.

Table 3: Communal M&E Servicing

Description	System
Heating	Electric panel heaters. Time & Temperature controlled.
Hot water	Point of use water heater.
Ventilation	Naturally ventilated
Lighting	100% Low Energy LED Lighting – 100 - 150lm/cw Automatic lighting controls with photosensitive dimming

Table 4: Apartment M&E Servicing

Description	System
Heating	Electric panel heaters Time & Temperature controlled
Hot water	Air source hot water cylinder (Dimplex Edel 200L or similar) 8l/min shower
Ventilation	Mechanical Ventilation with Heat Recovery (MVHR) including summer by-pass. (Mitsubishi VL-500CZPVU2 or similar) (Level 1 duct work insulation)
Lighting	100% Low Energy Lighting – 90lm/cw (LED or equivalent)

Table 5: House M&E Servicing

Description	System
Heating	Air source heat pump heating system serving radiators and domestic hot water cylinder, programmer, thermostat & TRVs. (Vaillant aroTHERM plus.)
Hot water	250L hot water cylinder (1.41kWh/day heat loss factor) 8l/min shower
Ventilation	Mechanical Ventilation with Heat Recovery (MVHR) including summer by-pass. (Nuaire MRXBOXAB-ECO2-LP2) (Level 1 duct work insulation)
Lighting	100% Low Energy Lighting – 90lm/cw (LED or equivalent)

Internal Water Efficiency

All new homes must meet the mandatory national standards set out within the Building Regulations and Part G covers water efficiency and is set at 125 litres/person/day. However, where there is a clear local need and local authorities require it, the government's Housing Optional Technical Standard should be used to help manage water demand and this sets a target of 105 litres/person/day – excluding 5 litre/person/day for external use, and the following water fitting performances should be targeted.

Appliance	Amount
WC (Dual flush)	4 Litres & 2.6 Litres
Taps	5 Litres / min
Kitchen Taps	6 Litres / min
Shower	8 Litres / min
Washing Machine	8.17 Litres / kg(dry)
Dishwasher	1.25 Litres (place setting)

4.0 Consideration for Pollution

The development is replacing an existing building on the site and as such additional local pollutants will be minimised as much as possible through the developments construction and operation. Pollution Prevention Guidance will be adhered to in respect of air (dust) and water (ground and surface) pollution during the demolition and construction phases and external light pollution will be controlled through a time switch, or daylight sensor, to prevent operation during daylight hours to limit the impact of artificial lighting for the development's residents and surrounding environment.

The proposal is for the development to be all electric, for space heating and hot water requirements, therefore there will be no gas, fossil or solid fuels burnt in conjunction with the operation of the dwellings and therefore no additional pollutants will be generated locally. Ventilation will be provided via Mechanical Ventilation with Heat Recovery (MVHR), which will provide a 'best practice' ventilation strategy in line with Energy Saving Trust guidance. The MVHR units will be used to manage indoor pollutants such as volatile organic compounds (VOC's), allergens (e.g. dust mites), and odours from cooking etc. effectively and efficiently, whilst also offering a summer bypass functionality to assist with managing summertime overheating risk.

To reduce the developments energy consumption, operating costs, and CO₂ emissions further a 'Green / Renewable' technology could be installed, with the following technologies officially recognized by the BRE as renewable and low carbon technologies:

- Solar Hot Water
- Photovoltaic Panels
- Wind turbines
- Heat Networks
- Community Biofuel Boilers
- Community Combined Heating & Power Systems
- Heat Pumps

Solar Hot Water

Solar water heating systems use the energy from the sun to heat water, most commonly for domestic hot water purposes. The system uses a heat collector, generally mounted on the roof and ideally orientated in a southerly orientation to capture the sun's solar rays to heat a fluid which is then used to heat up water stored in either a separate hot water cylinder or in a twin coil hot water cylinder inside the building. This could be done centrally and distributed to each apartment or via individual systems to each apartment.

- Simple 'hands-off' operation, proven technology with low maintenance requirements.
- Roof space and access is required for maintenance, and a secondary heating source is needed to ensure legionella protection.
- Difficult to implement centrally or individually to each dwelling due to piping requirements and plant space required.
- Limited energy and carbon saving potential.

Energy efficient technology but low carbon savings and complexity in installation make it unsuitable for this development.

Photovoltaic Panels

Photovoltaic systems convert energy from the sun into electricity through semi-conductor cells. These semi-conductor cells are connected together and mounted into modules. These modules are then connected to an inverter to turn their direct current (DC) output into an alternating current (AC) for use. PV systems require only daylight, not sunlight to generate electricity (although more electricity is produced with more sunlight), so energy can still be produced in overcast or cloudy conditions. Photovoltaic panels should ideally be orientated in a southerly orientation and inclined for self-cleaning and optimal performance.

- Simple 'hands-off' operation, proven technology with low maintenance requirements.
- Can be connected directly to individual dwellings or centrally and distributed.
- Roof space and access is required for maintenance.
- Carbon, energy and operating cost saving potential.

Energy efficient technology with high carbon saving potential and simple installation potential makes it appropriate for this development, although roof space is limited on houses.

Wind turbines

Wind turbines convert the power of wind into electricity by utilizing blades which are free to rotate into the wind. The blades then drive a generator either directly or via a gearbox (generally for larger machines) to produce electricity. An inverter is required to convert the electricity generated from a direct current (DC) to an alternating current (AC) and can then either be linked to the grid or used to charge batteries.

Modern wind turbines can be quiet, with simple maintenance requirements, but they can be large and can make a significant impact upon the local landscape. They also require reasonable and consistent wind speed to operate effectively.

- Low, variable and unpredictable wind speeds on site.
- Planning requirements.

Energy efficient technology but low carbon savings and complexity in installation make it unsuitable for this development.

Heat Networks

Heat networks provide an opportunity to supply heat to a collection of buildings from a central source. The heat is distributed via a network of underground pipes carrying hot water and can be scaled in size and capacity depending on the area and need. Connecting to a heat network avoids the need for individual boilers or electric heaters. The central heat source is often referred to as an 'energy centre'. There are many possible technologies that can provide the input to a heat network including power stations, energy from waste (EfW) facilities, industrial processes, biomass and biogas fuelled boilers and Combined Heat and Power (CHP) plants, gas-fired CHP units, fuel cells, heat pumps, geothermal sources, electric boilers and solar thermal arrays. Heat is brought into each building through a 'heat exchanger' which, for a residential connection, is about the same size as a small gas boiler. All of the same heating controls are available and to the end user the central heating and hot water system works in the same way as a domestic gas-fired central heating system without the need for any combustion to take place inside the building. A review of the local area has been undertaken and a heat network connection for this site has been discounted because:

- There are no existing decentralized energy or heating networks available.
- The site is not located near to any proposed energy or heat networks

A district energy or heating network isn't available and a local private heat network serving the apartment block and houses isn't practical at this time.

Community Biofuel Boilers

Biofuel heating systems use energy from biological matter such as wood chips, logs and pellets produced from managed forests, urban tree pruning, farmed coppices or farm and factory waste or they can use energy from biogas generated from a mixture of gases produced by the breakdown of organic matter in the absence of oxygen (anaerobic digestion). Biogas can be produced from regionally available raw materials such as recycled waste such as manure, sewage, municipal waste, green waste, plant material, and crops.

A centralised communal heating system would be required to serve the apartments and houses as Biofuel boilers require a base load for continual efficient operation along with local fuel storage facilities, regular de-ashing and maintenance, due to the varying quality of fuel used in the combustion process, to ensure optimal operation.

- Carbon savings possible, when using appropriately sourced fuels.
- Significant plant space required for equipment and fuel storage.
- Significant maintenance requirement to ensure optimal performance.
- Planning requirements for access and flueing.

Energy efficient technology but not suitable for location due to the significant site alterations required to accommodate equipment, fuel storage and fuel deliveries, in conjunction with the increased maintenance requirements of this technology makes it unsuitable for this development.

Community Combined Heating & Power Systems (CHP) 'Bio-fueled or Natural gas fired'

Combined Heating and Power systems utilise the by product of producing energy as a form of heating. When electricity is generated in central power stations around 65% of the primary energy is rejected as waste heat into the atmosphere. Combined heat and power units generate electricity locally so that the waste heat can be used for beneficial purposes for general heating or hot water purposes. Where all the waste heat generated can be used, CHP units can have overall efficiencies of up to 85% compared to 40% for conventional power stations. CHP systems are expensive, high maintenance and more suited to applications with a consistent thermal load such as a hospital, leisure centre or hotel.

- Carbon savings are possible, when on-site electricity generation is utilised.
- Significant central, community plant room requirements and maintenance.

Energy efficient technology with high capital and maintenance costs in conjunction with significant site alteration requirements make this technology unsuitable for this development.

Heat Pumps

Heat Pumps harvest the ambient heat from their natural surroundings for heating purposes. This is done by utilising an electrically driven vapour compression or absorption cycle to optimize the low-grade heat collected, to a usable heating level, which can then be used optimally in conjunction with either under floor heating circuits, over-sized radiators or to multi split air conditioning systems to provide heating/cooling as required. Heat pumps have some impact on the environment as they need electricity to run, but the heat they extract from the ground, air, or water is constantly being renewed naturally, and the efficiencies achievable are very high compared to other heating systems.

- Water Source Heat Pumps absorb energy from either open or closed loop pipes laid in local water sources, rivers, or lakes.
- Geothermal (Ground) Source Heat Pumps absorb energy from loop pipes buried in the ground either horizontally or vertically:
 - Horizontal
 - Slinkies or trenches 1 – 3m deep, which rely on large areas of land absorbing solar gains to replenish ground temperatures.
 - Vertical
 - Boreholes drilled deep into the earth 60m+, which relies on the fairly consistent year-round, static ground temperature.
- Air Source Heat Pumps absorb energy from the surrounding air.

Heat Pump technology could be installed communally via an ambient loop system with a mix of communal and local heat pumps, or via a centralised heat pump arrangement and local heat interface unit within each dwelling. Alternatively heat pumps could be installed individually as independent systems within each dwelling, via local air source heat pump hot water cylinders for domestic hot water generation or via a full heating and hot water system.

- Carbon emission and energy savings are possible.
- Internal & external plant space required.

Energy efficient technology with carbon saving potential, air source heat pump hot water systems provide an energy efficient route to enhance building performance.

Air source heat pump systems and photovoltaics present the most flexible, cost effective, energy efficient and carbon saving technologies for inclusion within this development, and an allowance has been made to enhance building performance in line with PfE and TANZ planning requirements.

Table 6: Renewable Technology

Description	System
Heating & Hot Water Houses	Air source heat pump serving radiators and domestic hot water cylinder.
Domestic Hot Water Apartments	Air source heat pump hot water cylinder.
Electricity generation	PV Panels (Circa 600Wp per panel) Houses – circa 8 panels - 4.8kWp (each) Apartment Block – circa 114 panels - 68kWp (Site requirement and capacity to be reviewed during detail design)

5.0 Analysis

The development is following GMCA Net Zero Design Guidance and the principles of the energy hierarchy, targeting building compactness and passive fabric first measures, with low U-value constructions used in conjunction with robust thermal bridging details to minimise heat losses and air leakage rates to minimise energy use. This then allows the scheme to move away from fossil fuels for heating and hot water generation to reduce carbon emissions.

This strategy aligns with GMCA's Places for Everyone policies JP-S2 and JP-S3, and the Truly Affordable Net Zero (TANZ) standard, which aims for all new buildings to be Net Zero Carbon in operation by 2028.

All dwellings across the development have been assessed and the average form factors have been calculated:

Apartments – **1.19** (range from 0.37 to 1.72)

Houses – **1.85** (range from 1.47 to 2.42)

SAP and DSM calculations have been undertaken for the development using the parameters outlined in Tables 1 - 6 to demonstrate a Building Regulation and planning compliant solution.

As per energy assessment guidance, each stage of the energy hierarchy has been modelled and each dwellings performance reviewed.

A 'Baseline' performance standard has been calculated in line with current Building Regulation requirements, based on the target emission rate (TER) as noted within table 7.

Table 7: Base Line Part L (2021) Building Performance – kg/CO ₂ /m ² per annum			
	Apartments	Apartments (Communal Areas)	Town Houses
Part L Baseline (TER)	12.88	0.25	9.99

Passive design measures have then been considered under Lean Building Performance, along with Clean 'active' M&E design measures.

Table 8: Lean & Clean Building Performance - kg/CO ₂ /m ² per annum			
	Apartments	Apartments (Communal Areas*)	Town Houses
Part L Baseline	12.88	0.25	9.99
Lean & Clean	3.93	2.25	3.86
Betterment	69.5%	-	61.3%

**Communal areas within the apartment block have limited external surfaces areas and servicing requirements and therefore requires PV for regulatory compliance to match the notional building standard.*

Table 9: Fabric Energy Efficiency			
	TFEE	DFEE	Improvement
	kWh/m ² .yr	kWh/m ² .yr	(%)
Development Total	26.94	28.58	5.74%

Table 10: Heating Demand		
	Apartments	Houses
	kWh/m ² .yr	kWh/m ² .yr
Target	15	20
Development Total	9.5	20

Details taken from SAP model (Line 99).

Table 11: Energy Use Intensity		
	Apartments	Houses
	kWh/m ² .yr	kWh/m ² .yr
Target	35	35
Development Total	68.27	56.34

Details taken from DSM modelling (appendix).

The all-electric solutions are then supported by a roof mounted photovoltaic array to support building operation and regulatory compliance in line with the TANZ standard.

Table 12: 'Net Zero' Green Building Performance - kg/CO ₂ /m ² per annum			
	Apartments	Apartments (Communal Areas)	Town Houses
Part L Baseline	12.88	0.25	9.99
Green (Design)	-0.45	-0.22	1.31
Betterment	103.47%	188%	86.85%

During the design stage, the proposal will be subject to more refined modelling based on the final building form, construction details and building services to optimise performance and photovoltaic capacity.

6.0 Conclusion

This energy strategy statement has assessed the proposed development in line with Rochdale Borough Councils climate change and sustainability policies and targets, as outlined within the Places for Everyone joint development plan, the GMCA design guide for Net Zero and TANZ. through energy performance modelling.

The scheme follows the energy hierarchy and Baseline energy performance figures have been calculated and improvements undertaken to fabrics and servicing with renewable technologies integrated within the design to ensure optimal building performance.

Lean measures proposed can be summarised as:

- Low U-value constructions with a low air permeability (3@50Pa)
- Highly efficient and robust thermal bridging detailing.
- Efficient and responsive M&E systems.
- Low energy LED lighting.
- High efficiency MVHR ventilation systems.

Green measures can be summarised as:

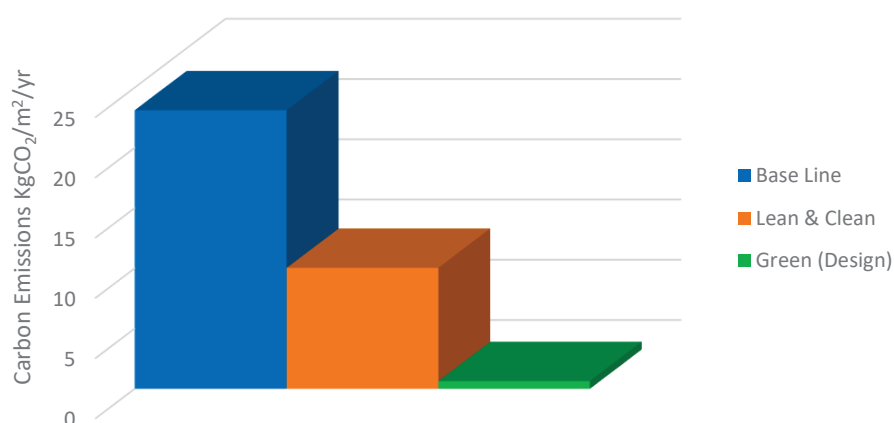
- No fossil fuel heating requirement.
- Air source heat pump heating and hot water systems.
- Roof mounted photovoltaics supporting building operation.

These measures enable the development to achieve an overall **97.2%** saving in regulated CO₂ emissions for the site and subject to actual building operation circa **46.5%** in operational energy.

Table 13: Overall Site Performance - kg/CO₂/m² per annum

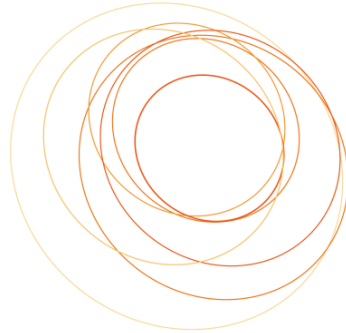
	Apartments	Apartments (communal Areas)	Town Houses	Carbon Savings
Part L Baseline	12.88	0.25	9.99	
Lean & Clean	3.93	2.25	3.86	13.08
Green (Design)	-0.45	-0.22	1.31	22.48
Overall CO₂ Saving	22.48 kg/CO₂/m² per annum		97.2%	

Overall Site - Regulated Carbon Emission Savings



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Riverside Business Park,
Benarth Road, Conwy, LL32 8UB.

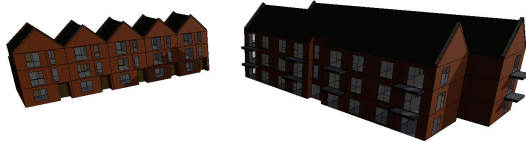
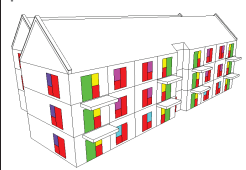
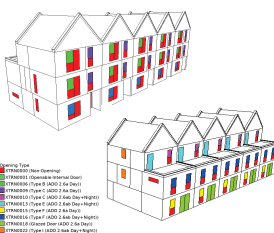
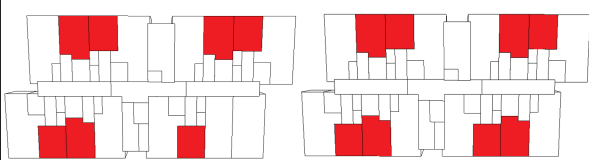
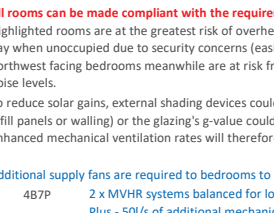
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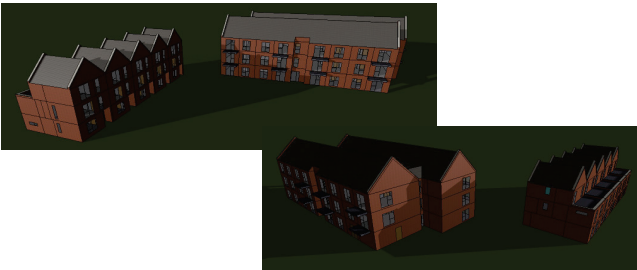


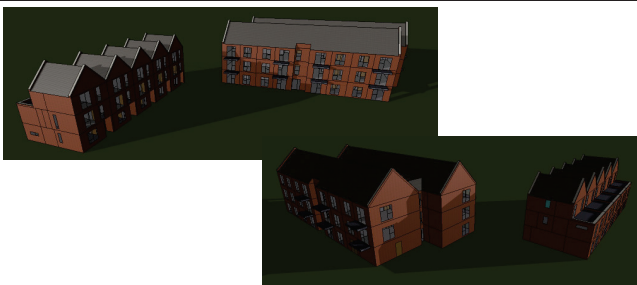
7.0 Appendix

- Part O – Overheating Analysis
 - Performance Summary
- Part L – Compliance calculations
 - Baseline 'Lean & Clean'
 - Proposed 'Green' Design
- Part L – Example calculations for communal areas, apartments and houses.
 - Baseline 'Lean'
 - Proposed 'Green'
- Energy Use Intensity Analysis
- GMCA 'TANZ' Proforma's

Building Regulations (2021) Part O Review & Guidance

Doc Ref: 25134-DPL-XX-XX-C-Y-9300		Project Name / Sample Unit: Queens Drive - ADO Performance Review	
1.1 Building and Site Details Residential Building Name/Number: Queens Drive Street / Floor: Rochdale Town: Manchester Postcode: OL11 Proposed building use/type: Mixed - Apartments / Housing Are there security, noise or pollution issues? YES Details: Part 'O' acceptable noise levels are exceeded and easily accessible and limited window openings are present, which may mean that windows/doors can't be used at all times to assist with overheating mitigation. Therefore enhanced mechanical ventilation may be required, making dynamic simulation necessary.			
1.2 Designer's Details Company: Davies Partnership Address Line 1: Cestrian House Address Line 2: Lightfoot Street, Hoole Postcode: CH2 3AD Contact Number: 01244 315 568 Email Address: Robert@daviespartnership.co.uk			
2a.1 Site Details Weather file location used: CIBSE Manchester DSY1 (2020) Overheating risk assessment: 50th percentile, high emissions Moderate Risk			
Design Data			
2b.1 Modelling Details Dynamic software name and version: IES VE 2024 Details of selection chosen: <i>All rooms have been modelled to ensure overall Part 'O' compliance, worst case performing rooms analysed in detail below.</i> Construction Performance: Floor: Light Weight External Wall: 0.12 Party Wall: 0.15 Internal Wall: 0 Internal Ceiling: n/a Air Permeability @50Pa: n/a Infiltration from CIBSE Guide A Table 4.24: 0.25 ach Note: <i>Base line performance specification to assist SAP/Part L compliance.</i> <i>Top hung outward opening windows, secure 'key locked' window openings restricted to 100mm.</i> <i>Potential to unrestrict for purge ventilation/cooling to be considered (ADO 650mm safe opening limit from inner wall face)</i> M&E Systems <i>Electric panel heating within each dwelling and MVHR ventilation.</i> <i>Enhanced (Part F) MVHR flow rates to be considered in conjunction with additional supply fans as/lf required.</i> Heat Mitigation Strategy <i>Window openings, glazing g-value & MVHR with summer by-pass ventilation.</i>		2b.2 Modelling Occupancy Have 'ADO' limits on CIBSE TM59 modelling methodology been applied: YES Details of Occupancy profile used: Part 'O' methodology Thermal Comfort Criteria: CIBSE TM52 (2013) Cat. II (Typical default) Details of the equipment profile used: Part 'O' methodology Details of the opening profile used: Part 'O' methodology 2b.3 Modelled Overheating Mitigation Strategy Free Areas: <i>Equivalent areas calculated using government approved Class cool spreadsheet based on calculated opening angles in line with 650mm maximum reach criteria, except for doors which are based on an opening of 90° and inward opening arrangements.</i> Have window dimensions and openings been modelled correctly? YES Have all security constraints, that might be required (grilles, shutters or railings), been factored into assumed window opening proportions? YES Have all safety constraints, including a check that all window cill heights and opening reach comply with AD-O requirements? YES Have all blinds, curtains, trees or foliage been excluded? YES Have any community heating pipework and HIU heat gains been included in the model? N/A Is mechanical cooling included in the design, or is mechanical ventilation relied upon for overheating mitigation? YES Have the mechanical ventilation flow rates been modelled? YES	
2b.4 Modelling Arrangement			
Apartments  Glazing areas exceed simplified ADO requirements for southerly facing dwellings and overall opening area's fail to meet ADO requirements . Excessive noise levels from queens drive will impact bedroom windows facing the road, meaning they'll be closed at night. Ground floor easily accessible bedroom windows present a security risk, limiting time of use and opening areas available. Rooms with windows facing southwest are at increased risk of experiencing excessive solar gains. Single sided ventilation only.		Houses  Glazing areas exceed simplified ADO requirements for westerly facing dwellings and overall opening area's fail to meet ADO requirements . Excessive noise levels from queens drive will impact bedroom windows facing the road, meaning they'll be closed at night. Ground floor easily accessible bedroom windows present a security risk, limiting time of use and opening areas available. Double bedrooms risk high internal heat gains over night and increase reliance on mechanical ventilation. Kitchen/dining and Lounge open to quieter rear of building and benefit from early morning sun, reducing daytime overheating risk. Cross ventilation is possible within the dwelling.	
2b.5 Modelling Test Results			
Apartment Performance testing (Unrestrictable window openings daytime use only / Boosted MVHR flow rates.)  Lower Floors Upper Floors		Housing Performance testing (Unrestrictable window openings daytime use only / Boosted MVHR flow rates.)  Ground Floor First Floor Second Floor	
All rooms can be made compliant with the requirements of Part O Highlighted rooms are at the greatest risk of overheating, as ground floor windows to bedrooms may be closed during the day when unoccupied due to security concerns (easily accessible), which may limit natural ventilation potential. Upper floor bedrooms struggle due to limited window openings due to excessive local noise levels, and southwest facing bedrooms are also at an increased risk from excessive solar gains. To reduce solar gains, external shading devices could be used, the area of glazing reduced (potentially through the use of infill panels or walling) or the glazing's g-value could be reduced. Enhanced mechanical ventilation rates will be required in all cases. Glazing with a g-value of 0.4 to southwest windows in conjunction with the following boosted MVHR rates achieve compliance: 1B2P Lounge - 46 l/s & Bedroom - 28 l/s Total (74l/s)		All rooms can be made compliant with the requirements of Part O Highlighted rooms are at the greatest risk of overheating, as ground floor windows to bedrooms may be closed during the day when unoccupied due to security concerns (easily accessible), which may limit natural ventilation potential. Upper floor northwest facing bedrooms meanwhile are at risk from solar gains and have limited window opening potential due to local noise levels. To reduce solar gains, external shading devices could be used, the area of glazing reduced (potentially through the use of infill panels or walling) or the glazing's g-value could be reduced. Enhanced mechanical ventilation rates will therefore be required. (beyond those levels achievable via the MVHR system) Additional supply fans are required to bedrooms to achieve ADO compliance. 4B7P 2 x MVHR systems balanced for lounge and bedroom ventilation Plus - 50l/s of additional mechanical ventilation (nighttime supply fan) to each bedroom (Part F)	
Performance Review			
The acoustic summary indicates that excessive noise levels are expected on and around the development, so windows and doors can't be relied upon at night. Noise levels to the rear of the houses is lower and these windows may be used if secure. Window and door use however is subject to tenant preference and ground floor bedrooms are a potential security risk (easily accessible) so key locked restricted windows, grills or louvers may be of assistance. Top hung outward opening windows should be unrestrictable when required both for occasional Part F purge ventilation purposes and to provide increased tenant flexibility in over heating management, rather than having to rely on mechanical means. MVHR systems should have a summer by pass function and be capable of boosted ventilation rates to assist with over heating mitigation. In the houses the MVHR alone won't be able to meet the ventilation rates required and additional manually controllable supply fans should be allowed for due to the potential overnight overheating risk. Passive measures to reduce over heating risk should be promoted and tenants encouraged to use windows and internal blinds proactively to reduce and limit heat gains, with light coloured or blackout blinds recommended as if used and 'closed' during the hottest periods of the day, especially when windows are sun facing, can help to reduce and reflect excessive solar gains from entering. Windows meanwhile should ideally be opened during cooler periods of the day and night, i.e. early morning and late evening as the cooler external air temperatures can be used to assist in freshening the dwelling and should then be closed during the hottest periods of the day to reduce heat from entering.			
2b.6 Design Assessor's Declaration			
Design Assessor's Name: Robert Buchanan		Date of Review/Issue: 03/12/2025	
Design Assessor's Organisation: Davies Partnership, Cestrian House, Lightfoot Street, Hoole, Chester, CH2 3AD			

Doc Ref: 25134-DPL-XX-XX-C-Y-9800		Project Name / Sample Unit: Potential 'Lean & Clean' Design Performance												
1.1 Building and Site Details														
Residential Building Name/Number: Apartment Block & Town Houses														
Street / Floor: Queens Drive														
Town: Rochdale														
Postcode: OL11														
1.1a Compliance Assessor														
Davies Partnership														
Cestrian House Lightfoot Street, Hoole, Chester CH2 3AD														
1.2 Part L Design Details														
Proposed building use/type: Residential Apartment Block & Town Houses														
Compliance Requirement?: Yes - Part L Volume 1 & 2 (New build))														
Details: <i>New build apartment block and town houses.</i>														
Communal accommodation must comply with the requirements of Part L (Volume 2 (2021)).														
Apartments and are present and must comply with Part L (Volume 1 (2021)).														
Design Data														
2a.1 Modelling Details		2a.2 M&E Servicing												
Non-Domestic software used: IES VE 2024		Communal												
Domestic Software used: Elmhurst Energy SAP10.2 (Nov 25)		Heating <i>Electric panel heating (100%) & Natural ventilation</i>												
All area's of the building have been modelled and tested as required.		Hot Water <i>Point of use water heater</i>												
		Lighting <i>200lx @ 100lm/cw - Corridors, Stairs, stores etc. (Presence detection)</i>												
		<i>200lx @ 120lm/cw - Plant Room (Manual)</i>												
Construction Performance: Medium Weight		Apartment												
Floor: 0.12 Limiting standard 0.18		Systems <i>Electric panel heating (100%)</i>												
External Wall: 0.15 Limiting standard 0.26		<i>200L Air source hot water cylinder (Dimplex Edel or similar)</i>												
Party Wall (heated adjacency): 0 Solid or full fill and edge seal party walls		<i>1x shower (8l/min)</i>												
Roof: 0.11 Limiting standard 0.16		<i>Mechanical Ventilation with Heat Recovery (Mitsubishi VL-500C2PVU or similar)</i>												
		<i>Low energy lighting 90lm/cw</i>												
Glazing (incl doors): 1.2 Limiting standard 1.6		Houses												
Solid Doors: 1.2 Limiting standard 1.6		Systems <i>Air source heat pump heating & Hot water system (Vaillant or similar)</i>												
Thermal Bridging: 0.07 Regulation default 0.2		<i>250L Hot water cylinder (1.41kWh/day)</i>												
Dwelling Air Permeability: 3 @ 50Pa Limiting standard 8 @ 50Pa		<i>3 x Showers (8l/min)</i>												
Communal Area Air Permeability: 5 @ 50Pa Limiting standard for buildings <500m ² is 15 @ 50Pa		<i>Mechanical Ventilation with Heat Recovery (Nuair MRXBOXAB-ECO-LP2 or similar)</i>												
		<i>Low energy lighting 90lm/cw</i>												
2b.1 Modelling Test Results														
2b.2 Part L Modelling Summary														
Apartments														
Ref.	EPC	Rating	Area	DER	TER	Margin	DFEE	TFEE	Margin	DPER	TPER	Margin	Part L	Co ₂ t/yr
1	B	85	50.15	4.64	14.39	67.76%	32.14	34.95	8.04%	48.46	76.13	36.35%	Pass	0.23
2	B	88	50.16	3.61	12.71	71.60%	24.51	26.28	6.74%	37.99	67.22	43.48%	Pass	0.18
3	B	88	50.16	3.61	12.72	71.62%	24.52	26.3	6.77%	38.04	67.26	43.44%	Pass	0.18
4	B	85	50.15	4.62	14.36	67.83%	31.83	34.7	8.27%	48.21	75.95	36.52%	Pass	0.23
5	B	85	50.15	4.74	13.97	66.07%	32.28	32.85	1.74%	49.49	73.87	33.00%	Pass	0.24
6	B	89	50.16	3.42	11.93	71.33%	22.45	22.3	-0.67%	36.15	63.03	42.65%	Pass	0.17
7	B	88	50.16	3.78	12.71	70.26%	25.29	26.04	2.88%	39.8	67.21	40.78%	Pass	0.19
8	B	88	50.15	3.61	12.83	71.86%	23.94	26.95	11.17%	38.06	67.76	43.83%	Pass	0.18
9	B	90	50.15	2.79	11.29	75.29%	16.44	18.55	11.37%	29.81	59.58	49.97%	Pass	0.14
10	B	90	50.15	2.8	11.31	75.24%	16.51	18.62	11.33%	29.9	59.68	49.90%	Pass	0.14
11	B	88	50.15	3.65	12.88	71.66%	24.13	27.18	11.22%	38.46	68.03	43.47%	Pass	0.18
12	B	88	50.15	3.72	12.63	70.55%	24.06	25.99	7.43%	39.16	66.65	41.25%	Pass	0.19
13	B	90	50.16	2.88	10.83	73.41%	15.01	16.24	7.57%	30.69	57.09	46.24%	Pass	0.14
14	B	91	50.15	2.72	10.81	74.84%	14.92	16.15	7.62%	29.12	56.98	48.89%	Pass	0.14
15	B	85	50.15	4.71	14.24	66.92%	30.56	33.59	9.02%	49.31	75.3	34.52%	Pass	0.24
16	B	84	50.15	4.88	14.25	65.75%	32.36	33.52	3.46%	51.04	75.38	32.29%	Pass	0.24
17	B	87	50.15	3.9	12.95	69.88%	25.31	26.43	4.24%	41.05	68.51	40.08%	Pass	0.20
18	B	86	50.15	4.16	12.97	67.93%	25.36	26.47	4.19%	43.71	68.59	36.27%	Pass	0.21
19	B	84	50.15	4.91	14.23	65.50%	32.54	33.4	2.57%	51.31	75.26	31.82%	Pass	0.25
20	B	84	50.15	5.01	13.97	64.14%	32.64	32.22	-1.30%	52.39	73.87	29.08%	Pass	0.25
21	B	87	50.16	3.77	12.41	69.62%	23.86	23.81	-0.21%	39.77	65.58	39.36%	Pass	0.19
22	B	88	50.15	3.76	12.39	69.65%	23.8	23.73	-0.29%	39.62	65.48	39.49%	Pass	0.19
23	B	85	50.15	4.65	13.42	65.35%	30.13	29.75	-1.28%	48.69	70.91	31.34%	Pass	0.23
			1153.51	90.34	296.2	69.50%	584.59	616.02	5.10%	950.23	1565.32	39.29%	Pass	4.53
Houses														
Ref.	EPC	Rating	Area	DER	TER	Margin	DFEE	TFEE	Margin	DPER	TPER	Margin	Part L	Co ₂ t/yr
24	C	80	129.19	4.14	10.77	61.56%	37.65	40.66	7.40%	43.62	56.31	22.54%	Pass	0.53
25	B	82	129.19	3.69	9.5	61.16%	31.62	34.44	8.19%	39.08	49.47	21.00%	Pass	0.48
26	B	82	129.19	3.69	9.5	61.16%	31.62	34.44	8.19%	39.08	49.47	21.00%	Pass	0.48
27	B	82	129.19	3.69	9.5	61.16%	31.62	34.44	8.19%	39.08	49.47	21.00%	Pass	0.48
28	C	80	129.19	4.11	10.68	61.52%	37.21	40.27	7.60%	43.33	55.83	22.39%	Pass	0.53
			645.95	19.32	49.95	61.32%	169.72	184.25	7.89%	204.19	260.55	21.63%	Pass	2.50
Communal Area (Apartments)														
Ref.	EPC	Rating	Area	BER	TER	Margin	BPER	TPER	Margin	Part L	Note	Co ₂ t/yr		
Baseline	B	31	175.59	2.25	0.25	-800.0%	24.35	1.91	-1174.9%	Fail	PV required for Compliance	0.40		
+PV	A	7	175.59	0.05	0.25	80.0%	-0.93	1.91	148.7%	Pass	8kWp PV array	0.01		
2b.3 Guidance														
Apartments achieve Part L compliance via the block compliance method, with all dwellings achieving an EPC 'B' rating.														
The heated communal areas within the apartment block fail to comply with the requirements of Part L without PV, An 8kWp PV array is needed to achieve compliance and allows the building to achieve an EPC 'A' rating.														
Houses comply individually and as a block with the requirements of Part L, with end plots achieving an EPC 'C' rating, and those houses in the middle an EPC 'B'.														
Significant carbon and energy savings are achievable via the fabric and servicing strategies proposed, however to achieve regulatory net zero building performance PV is required.														
3 Design Assessor's Declaration														
Design Assessor's Name: Robert Buchanan				Date of Review/issue: 03/12/2025										

Doc Ref: 25134-DPL-XX-XX-C-Y-9801		Project Name / Sample Unit: Potential 'Lean, Clean & Green' Design Performance													
1.1 Building and Site Details															
Residential Building Name/Number: Apartment Block & Town Houses															
Street / Floor: Queens Drive															
Town: Rochdale															
Postcode: OL11															
1.1a Compliance Assessor															
Davies Partnership Cestrian House Lightfoot Street, Hoole, Chester CH2 3AD															
1.2 Part L Design Details															
Proposed building use/type: Residential Apartment Block & Town Houses															
Compliance Requirement? Yes - Part L Volume 1 & 2 (New build))															
Details: <i>New build apartment block and town houses.</i> <i>Communal accommodation must comply with the requirements of Part L (Volume 2 (2021)).</i> <i>Apartments and are present and must comply with Part L (Volume 1 (2021)).</i>															
Design Data															
2a.1 Modelling Details		2a.2 M&E Servicing													
Non-Domestic software used: IES VE 2024		Communal													
Domestic Software used: Elmhurst Energy SAP10.2 (Nov 25)		Heating <i>Electric panel heating (100%) & Natural ventilation</i>													
<i>All area's of the building have been modelled and tested as required.</i>		Hot Water <i>Point of use water heater</i>													
Construction Performance: Medium Weight		Lighting <i>200lx @ 100lm/cw - Corridors, Stairs, stores etc. (Presence detection)</i> <i>200lx @ 120lm/cw - Plant Room (Manual)</i>													
Floor: 0.12 Limiting standard 0.18		Apartment													
External Wall: 0.15 Limiting standard 0.26		Systems <i>Electric panel heating (100%)</i> <i>200L Air source hot water cylinder (Dimplex Edel or similar)</i> <i>1x shower (8l/min)</i> <i>Mechanical Ventilation with Heat Recovery (Mitsubishi VL-500C2PVU or similar)</i> <i>Low energy lighting 90lm/cw</i>													
Party Wall (heated adjacency): 0 Solid or full fill and edge seal party walls		Houses													
Roof: 0.11 Limiting standard 0.16		Systems <i>Air source heat pump heating & Hot water system (Vaillant or similar)</i> <i>250L Hot water cylinder (1.41kWh/day)</i> <i>3 x Showers (8l/min)</i> <i>Mechanical Ventilation with Heat Recovery (Nuair MRXBOXAB-ECO-LP2 or similar)</i> <i>Low energy lighting 90lm/cw</i>													
Glazing (incl doors): 1.2 Limiting standard 1.6															
Solid Doors: 1.2 Limiting standard 1.6															
Thermal Bridging: 0.07 Regulation default 0.2															
Dwelling Air Permeability: 3 @ 50Pa Limiting standard 8 @ 50Pa <i>Air pressure testing required on completion</i>															
Communal Area Air Permeability: 5 @ 50Pa Limiting standard for buildings <500m ² is 15 @ 50Pa <i>Air pressure testing required on completion</i>															
2b.1 Modelling Test Results															
2b.2 Part L Modelling Summary															
Maximum PV capacity added to target regulatory 'Net Zero' carbon emission performance, based on 600Wp panels and area available.															
Apartments															
Ref.	PV (kWp)	EPC	Rating	Area	DER	TER	Margin	DFEE	TFEE	Margin	DPER	TPER	Margin	Part L	Co ₂ t/yr
1	3	A	97	50.15	-0.47	14.39	103.27%	32.14	34.95	8.04%	14.06	76.13	81.53%	Pass	-0.02
2	2.4	A	98	50.16	-0.49	12.71	103.86%	24.51	26.28	6.74%	9.38	67.22	86.05%	Pass	-0.02
3	2.4	A	98	50.16	-0.49	12.72	103.85%	24.52	26.3	6.77%	9.43	67.26	85.98%	Pass	-0.02
4	3	A	97	50.15	-0.49	14.36	103.41%	31.83	34.7	8.27%	13.83	75.95	81.79%	Pass	-0.02
5	3	A	97	50.15	-0.37	13.97	102.65%	32.28	32.85	1.74%	15.03	73.87	79.65%	Pass	-0.02
6	2.4	A	99	50.16	-0.67	11.93	105.62%	22.45	22.3	-0.67%	7.58	63.03	87.97%	Pass	-0.03
7	2.4	A	98	50.16	-0.31	12.71	102.44%	25.29	26.04	2.88%	11.14	67.21	83.43%	Pass	-0.02
8	2.4	A	98	50.15	-0.49	12.83	103.82%	23.94	26.95	11.17%	9.43	67.76	86.08%	Pass	-0.02
9	2	A	99	50.15	-0.63	11.29	105.58%	16.44	18.55	11.37%	5.21	59.58	91.26%	Pass	-0.03
10	2	A	99	50.15	-0.62	11.31	105.48%	16.51	18.62	11.33%	5.29	59.68	91.14%	Pass	-0.03
11	2.4	A	98	50.15	-0.45	12.88	103.49%	24.13	27.18	11.22%	9.83	68.03	85.55%	Pass	-0.02
12	2.4	A	98	50.15	-0.38	12.63	103.01%	24.06	25.99	7.43%	10.49	66.65	84.26%	Pass	-0.02
13	2	A	99	50.16	-0.54	10.83	104.99%	15.01	16.24	7.57%	6.08	57.09	89.35%	Pass	-0.03
14	2	A	99	50.15	-0.7	10.81	106.48%	14.92	16.15	7.62%	4.53	56.98	92.05%	Pass	-0.04
15	3	A	97	50.15	-0.4	14.24	102.81%	30.56	33.59	9.02%	14.74	75.3	80.42%	Pass	-0.02
16	3	A	96	50.15	-0.23	14.25	101.61%	32.36	33.52	3.46%	16.45	75.38	78.18%	Pass	-0.01
17	2.4	A	97	50.15	-0.2	12.95	101.54%	25.31	26.43	4.24%	12.31	68.51	82.03%	Pass	-0.01
18	2.8	A	98	50.15	-0.61	12.97	104.70%	25.36	26.47	4.19%	11.14	68.59	83.76%	Pass	-0.03
19	3	A	96	50.15	-0.2	14.23	101.41%	32.54	33.4	2.57%	16.71	75.26	77.80%	Pass	-0.01
20	3.2	A	96	50.15	-0.43	13.97	103.08%	32.64	32.22	-1.30%	15.9	73.87	78.48%	Pass	-0.02
21	2.4	A	98	50.16	-0.32	12.41	102.58%	23.86	23.81	-0.21%	11.05	65.58	83.15%	Pass	-0.02
22	2.4	A	98	50.15	-0.34	12.39	102.74%	23.8	23.73	-0.29%	10.91	65.48	83.34%	Pass	-0.02
23	3	A	97	50.15	-0.46	13.42	103.43%	30.13	29.75	-1.28%	14.14	70.91	80.06%	Pass	-0.02
59				1153.51	-10.29	296.2	103.47%	584.59	616.02	5.10%	254.66	1565.32	83.73%	Pass	-0.52
Houses															
Ref.	PV (kWp)	EPC	Rating	Area	DER	TER	Margin	DFEE	TFEE	Margin	DPER	TPER	Margin	Part L	Co ₂ t/yr
24	4.8	B	90	129.19	1.59	10.77	85.24%	37.65	40.66	7.40%	24.59	56.31	56.33%	Pass	0.21
25	4.8	A	92	129.19	1.14	9.5	88.00%	31.62	34.44	8.19%	20.14	49.47	59.29%	Pass	0.15
26	4.8	A	92	129.19	1.14	9.5	88.00%	31.62	34.44	8.19%	20.14	49.47	59.29%	Pass	0.15
27	4.8	A	92	129.19	1.14	9.5	88.00%	31.62	34.44	8.19%	20.14	49.47	59.29%	Pass	0.15
28	4.8	B	90	129.19	1.56	10.68	85.39%	37.21	40.27	7.60%	24.3	55.83	56.48%	Pass	0.20
24				645.95	6.57	49.95	86.85%	169.72	184.25	7.89%	109.31	260.55	58.05%	Pass	0.85
Communal Area (Apartments)															
Ref.	PV (kWp)	EPC	Rating	Area	BER	TER	Margin	BPER	TPER	Margin	Part L	Note	Co ₂ t/yr		
Net Zero	9	A +	-3	175.59	-0.22	0.25	188.0%	-4.09	1.91	314.1%	Pass	9kWp PV array	-0.04		
2b.3 Guidance															
The addition of 59kWp of photovoltaics spread over the Northeast/Southwest roofing and shared between the dwellings allows all of the apartments to achieve both an EPC 'A' level of energy performance and a regulatory net zero carbon emission performance.															
The communal area requires 9kWp of PV spread over the Northeast/Southwest roofing to achieve an EPC 'A+' regulatory net zero level of performance.															
Maximising the area of PV on the houses to 4.8kWp generates significant carbon emission savings and enables an EPC 'B' level of performance for the end dwellings and an EPC 'A' level of performance for the middle homes.															
3 Design Assessor's Declaration															
Design Assessor's Name:				Robert Buchanan				Date of Review/Issue:				03/12/2025			

Project name

Lean & Clean

As designed

Date: Wed Dec 03 14:44:58 2025

Administrative information

Building Details

Address: Apartment Block (Communal Area), Rochdale,

Certifier details

Name: Davies Partnership

Telephone number: 01244315568

Address: Cestrian House, Lightfoot Street, Hoole,, Chester,
CH2 3AD

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 88.6The 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	0.25
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	2.25
Target primary energy rate (TPER), kWh _{PE} /m ² annum	1.91
Building primary energy rate (BPER), kWh _{PE} /m ² annum	24.35
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	0.15	0.15	FL00001B:Surf[1]
Floors	0.18	0.12	0.12	FL000009:Surf[0]
Pitched roofs	0.16	0.11	0.11	F1000027:Surf[1]
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.2	1.2	FL00001A:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors [^]	1.6	1.6	1.6	FL00001B:Surf[2]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _{a-Limit} = Limiting area-weighted average U-values [W/(m ² K)] U _{a-Calc} = Calculated area-weighted average U-values [W/(m ² K)] U _{i-Calc} = Calculated maximum individual element U-values [W/(m ² K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m ² K 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- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- 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/m ²]
	Standard value	95	80	0.3
[F] 0F XX Bike Store		100	-	-
[F] 0F XX Corridor		100	-	-
[F] 0F XX Corridor		100	-	-
[F] 0F XX Corridor		100	-	-
[F] 0F XX Corridor		100	-	-
[F] 0F XX Plant Room		120	-	-
[F] 0F XX Riser		120	-	-
[F] 0F XX Stairwell		100	-	-
[F] 1F XX Corridor		100	-	-
[F] 1F XX Corridor		100	-	-
[F] 1F XX Corridor		100	-	-
[F] 1F XX Corridor		100	-	-
[F] 1F XX Riser		120	-	-
[F] 1F XX Stairwell		100	-	-
[F] 2F XX Corridor		100	-	-
[F] 2F XX Corridor		100	-	-
[F] 2F XX Corridor		100	-	-
[F] 2F XX Corridor		100	-	-
[F] 2F XX Riser		120	-	-
[F] 2F XX Stairwell		100	-	-

The spaces in the building should have appropriate passive control measures to limit the effects of solar gains in summer

There are no zones in the building where the solar gain check is applicable.

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]	325.1	325.1
External area [m ²]	1103.1	371.4
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	5278.49	95.87
Average U-value [W/m ² K]	4.79	0.26
Alpha value* [%]	1.37	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 Storage or Distribution
 Hotels

21 Residential Institutions: Hospitals and Care Homes

Residential Institutions: Residential Schools
 Residential Institutions: Universities and Colleges
 Secure Residential Institutions

79 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	1.35	1.95
Cooling	0	0
Auxiliary	0	0
Lighting	14.68	7.9
Hot water	0	0
Equipment*	63.13	63.13
TOTAL**	16.03	9.85

* 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	8.65
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>8.65</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	4.87	9.92
Primary energy [kWh _{PE} /m ²]	24.35	1.91
Total emissions [kg/m ²]	2.25	0.25

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	6	0	1.7	0	0	1	0	1	0
	Notional	12.1	0	2.4	0	0	1.41	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	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

Lean Clean & Green

As designed

Date: Wed Dec 03 14:47:14 2025

Administrative information

Building Details

Address: Apartment Block (Communal Area), Rochdale,

Certifier details

Name: Davies Partnership

Telephone number: 01244315568

Address: Cestrian House, Lightfoot Street, Hoole,, Chester,
CH2 3AD

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 88.6The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	0.25
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	-0.22
Target primary energy rate (TPER), kWh _{PE} /m ² annum	1.91
Building primary energy rate (BPER), kWh _{PE} /m ² annum	-4.09
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	0.15	0.15	FL00001B:Surf[1]
Floors	0.18	0.12	0.12	FL000009:Surf[0]
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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- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- 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
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[F] 0F XX Corridor		100	-	-
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[F] 2F XX Corridor		100	-	-
[F] 2F XX Corridor		100	-	-
[F] 2F XX Riser		120	-	-
[F] 2F XX Stairwell		100	-	-

The spaces in the building should have appropriate passive control measures to limit the effects of solar gains in summer

There are no zones in the building where the solar gain check is applicable.

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]	325.1	325.1
External area [m ²]	1103.1	371.4
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	5278.49	95.87
Average U-value [W/m ² K]	4.79	0.26
Alpha value* [%]	1.37	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
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 Hotels

21 Residential Institutions: Hospitals and Care Homes

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 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	1.35	1.95
Cooling	0	0
Auxiliary	0	0
Lighting	14.68	7.9
Hot water	0	0
Equipment*	63.13	63.13
TOTAL**	16.03	9.85

* 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	19.37	8.65
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>19.37</i>	<i>8.65</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	4.87	9.92
Primary energy [kWh _{PE} /m ²]	-4.09	1.91
Total emissions [kg/m ²]	-0.22	0.25

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	6	0	1.7	0	0	1	0	1	0
	Notional	12.1	0	2.4	0	0	1.41	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	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

Full SAP Calculation Printout



Plot Reference	Lean, Clean - Plot 08			Issued on Date	03/12/2025
Assessment Reference	Plot 08	Plot Type Ref			
Plot Address	P08			SAP Version	10.2
SAP Rating	88 B	DER	3.61	TER	12.83
Environmental	98 A	% DER < TER			71.86
CO ₂ Emissions (t/year)	0.18	DFEE	23.94	TFEE	26.95
Compliance Check	See BREL	% DFEE < TFEE			11.19
% DPER < TPER	43.84	DPER	38.06	TPER	67.76
Assessor Details	Mr. Robert Buchanan			Assessor ID	DU20-0001
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)
Main dwelling			
Ground floor	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.3600 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 = 0.0000 (6a)											
Number of open flues	0 * 20 = 0.0000 (6b)											
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)											
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)											
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)											
Number of blocked chimneys	0 * 20 = 0.0000 (6f)											
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)											
Number of passive vents	0 * 10 = 0.0000 (7b)											
Number of flueless gas fires	0 * 40 = 0.0000 (7c)											
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)											
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	3.0000 (17)											
Infiltration rate	0.1500 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (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)
Balanced mechanical ventilation with heat recovery	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
If mechanical ventilation	0.5000 (23a)											
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)											
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)											
Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403 (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
Main dwelling							
Windows / Glazed Doors			10.9300	1.1450	12.5153		(27)
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840 (29a)
Total net area of external elements A _{um} (A, m ²)			36.1680				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3010		(33)
Main dwelling							
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000 (32)
Party Floor 1			50.1500			30.0000	1504.5000 (32d)
Party Ceiling 1			50.1500			20.0000	1003.0000 (32b)
Internal Wall 1			84.8200			9.0000	763.3800 (32c)
Heat capacity C _m = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 4362.5640 (34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							86.9903 (35)
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	18.8327 (37)

Full SAP Calculation Printout



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.0513	9.9247	9.7981	9.1651	9.0385	8.4055	8.4055	8.2789	8.6587	9.0385	9.2917	9.5449	(38)
Heat transfer coeff	28.8841	28.7575	28.6309	27.9978	27.8712	27.2382	27.2382	27.1116	27.4914	27.8712	28.1244	28.3777	(39)
Average = Sum(39)m / 12 =												27.9662	
HLP	0.5760	0.5734	0.5709	0.5583	0.5558	0.5431	0.5431	0.5406	0.5482	0.5558	0.5608	0.5659	(40)
HLP (average)												0.5577	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6945	(42)
Hot water usage for mixer showers														
52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293	52.4293	(42a)	
Hot water usage for baths														
22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	22.6793	(42b)	
Hot water usage for other uses														
31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	31.9836	(42c)	
Average daily hot water use (litres/day)												98.6986	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922	107.0922	(44)	
Energy conte	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806	(45)	
Energy content (annual)										Total = Sum(45)m =	1639.3633			
Distribution loss (46)m = 0.15 x (45)m														
25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521	25.1521	(46)	
Water storage loss (or HIU loss):														
Store volume												201.0000	(47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)	
Temperature factor from Table 2b												0.5400	(49)	
Enter (49) or (54) in (55)												0.8694	(55)	
Total storage loss														
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	(56)	
If cylinder contains dedicated solar storage														
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month														
197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	194.6320	(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														
197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	194.6320	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =	1956.6943	1957	(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														
56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538	55.7538	(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	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.5099	82.4931	74.5099	76.9935	74.5099	76.9935	74.5099	74.5099	76.9935	74.5099	76.9935	74.5099	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.6235	149.1554	145.2951	137.0771	126.7033	116.9534	110.4398	108.9080	112.7682	120.9863	131.3601	141.1100	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	(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)													
	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)
Water heating gains (Table 5)													
	75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379	(72)
Total internal gains													
	346.5476	354.1024	338.4821	324.4692	306.5411	293.9746	281.7217	282.8792	292.3763	303.9918	324.7851	338.9755	(73)

6. Solar gains

[Jan]												Gains
			Area	Solar flux		g		FF		Access		W
			m2	Table 6a		Specific data		Specific data		factor		
				W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast			7.1300	11.2829		0.6000		0.7000		0.7700		23.4150
Northwest			3.8000	11.2829		0.6000		0.7000		0.7700		(75)
Solar gains	35.8943	73.0638	131.6377	216.1870	290.5977	309.8079	289.8190	231.0470	160.4026	89.2898	45.1643	29.3131
Total gains	382.4418	427.1662	470.1198	540.6562	597.1388	603.7826	571.5407	513.9262	452.7789	393.2815	369.9494	(83)
												368.2886
												(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	41.9547	42.1394	42.3258	43.2827	43.4794	44.4898	44.4898	44.6976	44.0800	43.4794	43.0879	42.7034		
alpha	3.7970	3.8093	3.8217	3.8855	3.8986	3.9660	3.9660	3.9798	3.9387	3.8986	3.8725	3.8469		
util living area														

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	0.8722	0.8227	0.7407	0.5842	0.4244	0.2872	0.2094	0.2420	0.4109	0.6610	0.8161	0.8819 (86)
MIT	20.1630	20.3717	20.6226	20.8700	20.9673	20.9949	20.9989	20.9981	20.9793	20.8301	20.4956	20.1411 (87)
Th 2	20.4517	20.4540	20.4563	20.4677	20.4700	20.4814	20.4814	20.4837	20.4769	20.4700	20.4654	20.4608 (88)
util rest of house	0.8621	0.8099	0.7239	0.5633	0.4018	0.2643	0.1848	0.2151	0.3815	0.6363	0.8011	0.8724 (89)
MIT 2	19.4640	19.7216	20.0273	20.3271	20.4372	20.4770	20.4807	20.4823	20.4580	20.2890	19.8870	19.4444 (90)
Living area fraction									fLA = Living area / (4) =			0.4391 (91)
MIT	19.7710	20.0070	20.2887	20.5655	20.6700	20.7044	20.7082	20.7088	20.6869	20.5266	20.1542	19.7503 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7710	20.0070	20.2887	20.5655	20.6700	20.7044	20.7082	20.7088	20.6869	20.5266	20.1542	19.7503 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8483	0.7987	0.7185	0.5672	0.4104	0.2742	0.1955	0.2268	0.3934	0.6390	0.7917	0.8587	(94)
Useful gains	324.4144	341.1790	337.7647	306.6657	245.0568	165.5467	111.7605	116.5696	178.1097	251.3197	292.9002	316.2336	(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	446.8643	434.4403	394.7823	326.6087	250.0037	166.2719	111.9003	116.8180	181.0825	276.6663	367.1428	441.2812	(97)
Space heating kWh	91.1027	62.6716	42.4211	14.3590	3.6805	0.0000	0.0000	0.0000	0.0000	18.8579	53.4547	93.0354	(98a)
Space heating requirement - total per year (kWh/year)												379.5829	
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	91.1027	62.6716	42.4211	14.3590	3.6805	0.0000	0.0000	0.0000	0.0000	18.8579	53.4547	93.0354	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												379.5829	
Space heating per m2										(98c) / (4) =		7.5690	(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)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (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	91.1027	62.6716	42.4211	14.3590	3.6805	0.0000	0.0000	0.0000	0.0000	18.8579	53.4547	93.0354	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	91.1027	62.6716	42.4211	14.3590	3.6805	0.0000	0.0000	0.0000	0.0000	18.8579	53.4547	93.0354	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030	(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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713	(231)
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964	(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												379.5829	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												349.4100	
Water heating fuel used												559.9995	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)													
mechanical ventilation fans (SFP = 1.0000)													146.8392 (230a)
Total electricity for the above, kWh/year													146.8392 (231)
Electricity for lighting (calculated in Appendix L)													152.3068 (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)

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Energy used 0.0000 (237)
Total delivered energy for all uses 1238.7285 (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	379.5829	0.1573	59.7079 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			138.7313 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Total CO2, kg/year			181.0823 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6100 (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	379.5829	1.5823	600.6143 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	1.5218	852.2053 (278)
Space and water heating			1452.8197 (279)
Pumps, fans and electric keep-hot	146.8392	1.5128	222.1384 (281)
Energy for lighting	152.3068	1.5338	233.6133 (282)
Total Primary energy kWh/year			1908.5714 (286)
Dwelling Primary energy Rate (DPER)			38.0600 (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)
Main dwelling	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.3600 (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) = 0.1662 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4162 (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) = 0.3537 (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	0.4510	0.4422	0.4333	0.3891	0.3803	0.3361	0.3361	0.3272	0.3537	0.3803	0.3980	0.4156 (22b)
Effective ac	0.6017	0.5978	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864 (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
Main dwelling							
TER Opening Type			10.9300	1.1450	12.5153		(27)
External Wall	36.1680	10.9300	25.2380	0.1800	4.5428		(29a)
Total net area of external elements Aum(A, m2)			36.1680				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.0581		(33)
Main dwelling							
Party Wall 1			31.8700	0.0000	0.0000		(32)

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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)	5.2100	0.0500	0.2605	
E3 Sill	3.4000	0.0500	0.1700	
E4 Jamb	12.6000	0.0500	0.6300	
E7 Party floor between dwellings (in blocks of flats)	12.1350	0.0700	0.8495	
E16 Corner (normal)	4.8000	0.0900	0.4320	
E18 Party wall between dwellings	2.4000	0.0600	0.1440	
E7 Party floor between dwellings (in blocks of flats)	12.1350	0.0700	0.8495	
E25 Staggered party wall between dwellings	2.4000	0.0600	0.1440	
E9 Balcony between dwellings, wall insulation continuous	5.8700	0.0200	0.1174	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.2800	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.2800	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.5968	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	20.6549	(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	23.8992	23.7424	23.5886	22.8664	22.7312	22.1022	22.1022	21.9857	22.3445	22.7312	23.0046	23.2904	(38)
Heat transfer coeff	44.5541	44.3973	44.2435	43.5213	43.3861	42.7571	42.7571	42.6406	42.9994	43.3861	43.6595	43.9453	(39)
Average = Sum(39)m / 12 =												43.5206	
HLP	0.8884	0.8853	0.8822	0.8678	0.8651	0.8526	0.8526	0.8503	0.8574	0.8651	0.8706	0.8763	(40)
HLP (average)												0.8678	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6945	(42)
Hot water usage for mixer showers	52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293	(42a)	
Hot water usage for baths	22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	(42b)	
Hot water usage for other uses	31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	(42c)	
Average daily hot water use (litres/day)												98.6986	(43)	
Daily hot water use	107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922	(44)	
Energy conte	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806	(45)	
Energy content (annual)										Total = Sum(45)m =		1639.3633		
Distribution loss (46)m = 0.15 x (45)m	25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521	(46)	
Water storage loss (or HIU 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	216.6440	191.7166	203.8068	179.3059	173.9367	156.8488	154.7921	160.8097	162.4502	181.0247	192.3697	214.2755	(62)	
WWHRS	-24.0607	-21.2795	-22.2826	-18.4509	-17.1956	-14.7144	-13.7924	-14.6668	-15.2241	-17.9475	-20.3323	-23.6151	(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	192.5833	170.4372	181.5241	160.8550	156.7412	142.1344	140.9997	146.1429	147.2261	163.0773	172.0374	190.6603	(64)	
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1964.4189	(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	93.8173	83.4209	89.5489	80.6996	79.6171	73.2327	73.2515	75.2524	75.0951	81.9738	85.0434	93.0297	(65)	

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

Metabolic gains (Table 5), Watts														
(66)m	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.5099	82.4931	74.5099	76.9935	74.5099	76.9935	74.5099	74.5099	76.9935	74.5099	76.9935	74.5099	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.6235	149.1554	145.2951	137.0771	126.7033	116.9534	110.4398	108.9080	112.7682	120.9863	131.3601	141.1100	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	(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)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)	
Water heating gains (Table 5)	126.0985	124.1382	120.3614	112.0828	107.0122	101.7120	98.4563	101.1456	104.2988	110.1799	118.1158	125.0399	(72)	
Total internal gains	399.6496	407.2044	391.5841	377.5712	359.6431	344.0767	331.8238	332.9812	342.4783	357.0938	377.8872	392.0776	(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	7.1300	11.2829	0.6300	0.7000	0.7700	24.5858 (75)

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Northwest			3.8000		11.2829		0.6300		0.7000		0.7700		13.1032 (81)	
Solar gains	37.6890	76.7170	138.2196	226.9963	305.1276	325.2983	304.3099	242.5994	168.4228	93.7543	47.4225	30.7787 (83)		
Total gains	437.3386	483.9214	529.8038	604.5676	664.7707	669.3750	636.1337	575.5806	510.9011	450.8481	425.3097	422.8563 (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	27.1989	27.2950	27.3899	27.8444	27.9311	28.3420	28.3420	28.4195	28.1823	27.9311	27.7562	27.5757		
alpha	2.8133	2.8197	2.8260	2.8563	2.8621	2.8895	2.8895	2.8946	2.8788	2.8621	2.8504	2.8384		
util living area	0.8935	0.8612	0.8046	0.6876	0.5401	0.3900	0.2895	0.3307	0.5228	0.7414	0.8543	0.9004	(86)	
MIT	19.2715	19.5399	19.9442	20.4527	20.7804	20.9375	20.9804	20.9711	20.8532	20.4221	19.7997	19.2419	(87)	
Th 2	20.1774	20.1800	20.1826	20.1949	20.1972	20.2080	20.2080	20.2100	20.2038	20.1972	20.1926	20.1877	(88)	
util rest of house	0.8825	0.8474	0.7857	0.6600	0.5036	0.3462	0.2394	0.2770	0.4740	0.7109	0.8379	0.8901	(89)	
MIT 2	18.1594	18.4934	18.9923	19.6088	19.9826	20.1565	20.1955	20.1907	20.0748	19.5895	18.8310	18.1295	(90)	
Living area fraction	fLA = Living area / (4) =													
MIT	18.6477	18.9529	19.4103	19.9794	20.3329	20.4994	20.5401	20.5334	20.4166	19.9551	19.2563	18.6179	(91)	
Temperature adjustment	0.0000													
adjusted MIT	18.6477	18.9529	19.4103	19.9794	20.3329	20.4994	20.5401	20.5334	20.4166	19.9551	19.2563	18.6179	(93)	

8. Space heating requirement														

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.8580	0.8235	0.7657	0.6522	0.5100	0.3625	0.2606	0.2992	0.4874	0.7010	0.8158	0.8661	(94)	
Useful gains	375.2566	398.5260	405.6921	394.2847	339.0182	242.6579	165.7887	172.2320	249.0264	316.0342	346.9784	366.2316	(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	639.2500	623.9093	571.1963	482.1887	374.5484	252.2427	168.4683	176.2491	271.6089	405.8806	530.7398	633.5988	(97)	
Space heating kWh	196.4112	151.4575	123.1351	63.2909	26.4345	0.0000	0.0000	0.0000	0.0000	66.8457	132.3082	198.9212	(98a)	
Space heating requirement - total per year (kWh/year)													958.8043	
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	196.4112	151.4575	123.1351	63.2909	26.4345	0.0000	0.0000	0.0000	0.0000	66.8457	132.3082	198.9212	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)													958.8043	
Space heating per m2	(98c) / (4) =												19.1187 (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	196.4112	151.4575	123.1351	63.2909	26.4345	0.0000	0.0000	0.0000	0.0000	66.8457	132.3082	198.9212	(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)	212.7965	164.0927	133.4075	68.5708	28.6398	0.0000	0.0000	0.0000	0.0000	72.4222	143.3459	215.5159	(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	192.5833	170.4372	181.5241	160.8550	156.7412	142.1344	140.9997	146.1429	147.2261	163.0773	172.0374	190.6603	(64)	
Water heating requirement	84.1040	83.7960	83.2085	82.1510	80.9845	79.8000	79.8000	79.8000	79.8000	82.2228	83.4781	84.1550	(217)	
Efficiency of water heater (217)m	228.9825	203.3952	218.1557	195.8040	193.5446	178.1133	176.6913	183.1365	184.4939	198.3359	206.0869	226.5584	(219)	
Fuel for 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	(221)	
Space cooling fuel requirement (221)m	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)	
Pumps and Fa	15.4817	12.4200	11.1828	8.1930	6.3285	5.1705	5.7731	7.5041	9.7470	12.7887	14.4448	15.9120	(232)	
Lighting	-17.2665	-25.2395	-37.6140	-43.9205	-48.8065	-46.1178	-45.5841	-42.3318	-36.8159	-29.6085	-19.3093	-14.8273	(233a)	
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	(234a)	
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	(235a)	
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	-7.2100	-15.3994	-31.0312	-47.2193	-63.0170	-63.4989	-62.7213	-52.8158	-38.3520	-22.1910	-9.6834	-5.6821	(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													1038.7912 (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													2393.2983 (219)	
Space cooling fuel													0.0000 (221)	

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Electricity for pumps and fans:
Total electricity for the above, kWh/year 86.0000 (231)
Electricity for lighting (calculated in Appendix L) 124.9460 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -826.2632 (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 2816.7724 (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	1038.7912	0.2100	218.1462 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2393.2983	0.2100	502.5926 (264)
Space and water heating			720.7388 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	124.9460	0.1443	18.0336 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-407.4418	0.1338	-54.5168
PV Unit electricity exported	-418.8214	0.1255	-52.5733
Total			-107.0901 (269)
Total CO2, kg/year			643.6115 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.8300 (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	1038.7912	1.1300	1173.8341 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2393.2983	1.1300	2704.4271 (278)
Space and water heating			3878.2611 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	124.9460	1.5338	191.6464 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-407.4418	1.4945	-608.9084
PV Unit electricity exported	-418.8214	0.4608	-192.9734
Total			-801.8818 (283)
Total Primary energy kWh/year			3398.1266 (286)
Target Primary Energy Rate (TPER)			67.7600 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 120.3600 (5)
Dwelling volume			

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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) = 0.1662 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 3.0000 (17)
Infiltration rate 0.3162 (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) = 0.2687 (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)

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Adj infilt rate	0.3426	0.3359	0.3292	0.2956	0.2889	0.2553	0.2553	0.2486	0.2687	0.2889	0.3023	0.3158 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5587	0.5564	0.5542	0.5437	0.5417	0.5326	0.5326	0.5309	0.5361	0.5417	0.5457	0.5499 (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						
Main dwelling													
Windows / Glazed Doors			10.9300	1.1450	12.5153			(27)					
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840	(29a)					
Total net area of external elements Aum(A, m2)			36.1680					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.3010			(33)					
Main dwelling													
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000	(32)					
Party Floor 1			50.1500			30.0000	1504.5000	(32d)					
Party Ceiling 1			50.1500			20.0000	1003.0000	(32b)					
Internal Wall 1			84.8200			9.0000	763.3800	(32c)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4362.5640	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9903	(35)					
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	18.8327	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 22.1910	Feb 22.1005	Mar 22.0117	Apr 21.5949	May 21.5169	Jun 21.1539	Jul 21.1539	Aug 21.0866	Sep 21.2937	Oct 21.5169	Nov 21.6747	Dec 21.8396	(38)
Heat transfer coeff	41.0238	40.9332	40.8445	40.4276	40.3496	39.9866	39.9866	39.9194	40.1264	40.3496	40.5074	40.6724	(39)
Average = Sum(39)m / 12 =												40.4273	
HLP	Jan 0.8180	Feb 0.8162	Mar 0.8144	Apr 0.8061	May 0.8046	Jun 0.7973	Jul 0.7973	Aug 0.7960	Sep 0.8001	Oct 0.8046	Nov 0.8077	Dec 0.8110	(40)
HLP (average)												0.8061	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6945 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	(42b)
Hot water usage for other uses	31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	(42c)
Average daily hot water use (litres/day)												50.1746	(43)
Daily hot water use	Jan 54.7398	Feb 53.2388	Mar 51.5999	Apr 49.5593	May 47.7392	Jun 45.8476	Jul 45.4540	Aug 47.0897	Sep 48.7673	Oct 50.7099	Nov 52.7685	Dec 54.6629	(44)
Energy conte	86.6945	75.8114	79.3071	67.8442	64.2661	56.3749	54.9727	58.3068	60.1349	68.8129	75.1785	85.5889	(45)
Energy content (annual)										Total = Sum(45)m =		833.2930	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	73.6903	64.4397	67.4110	57.6676	54.6262	47.9187	46.7268	49.5608	51.1147	58.4910	63.9017	72.7506	(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	73.6903	64.4397	67.4110	57.6676	54.6262	47.9187	46.7268	49.5608	51.1147	58.4910	63.9017	72.7506	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				708.2991	(64)
Electric shower(s)	42.1486	37.5548	41.0084	39.1338	39.8681	38.0303	39.2980	39.8681	39.1338	41.0084	40.2373	42.1486	(64a)
Heat gains from water heating, kWh/month	28.9597	25.4986	27.1049	24.2003	23.6236	21.4873	21.5062	22.3572	22.5621	24.8748	26.0347	28.7248	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan 84.7259	Feb 84.7259	Mar 84.7259	Apr 84.7259	May 84.7259	Jun 84.7259	Jul 84.7259	Aug 84.7259	Sep 84.7259	Oct 84.7259	Nov 84.7259	Dec 84.7259	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.5099	82.4931	74.5099	76.9935	74.5099	76.9935	74.5099	74.5099	76.9935	74.5099	76.9935	74.5099	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.6235	149.1554	145.2951	137.0771	126.7033	116.9534	110.4398	108.9080	112.7682	120.9863	131.3601	141.1100	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	(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)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)
Water heating gains (Table 5)	38.9244	37.9444	36.4313	33.6116	31.7521	29.8434	28.9062	30.0501	31.3363	33.4339	36.1594	38.6086	(72)
Total internal gains	309.4756	318.0106	304.6540	296.1000	281.3831	272.2081	262.2737	261.8857	269.5158	277.3478	292.9307	302.6462	(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
Northeast			7.1300	11.2829	0.6000	0.7000	0.7700	23.4150 (75)
Northwest			3.8000	11.2829	0.6000	0.7000	0.7700	12.4792 (81)
Solar gains	35.8943	73.0638	131.6377	216.1870	290.5977	309.8079	289.8190	231.0470
Total gains	345.3698	391.0744	436.2918	512.2870	571.9808	582.0160	552.0926	492.9327

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	29.5395	29.6049	29.6692	29.9751	30.0331	30.3057	30.3057	30.3568	30.2001	30.0331	29.9161	29.7948
alpha	2.9693	2.9737	2.9779	2.9983	3.0022	3.0204	3.0204	3.0238	3.0133	3.0022	2.9944	2.9863
util living area	0.9305	0.9015	0.8493	0.7323	0.5779	0.4183	0.3117	0.3605	0.5706	0.7983	0.9002	0.9369 (86)
MIT	19.1667	19.4540	19.8809	20.4224	20.7735	20.9367	20.9805	20.9698	20.8396	20.3564	19.6903	19.1179 (87)
Th 2	20.2377	20.2393	20.2408	20.2480	20.2494	20.2556	20.2556	20.2568	20.2532	20.2494	20.2466	20.2438 (88)
util rest of house	0.9230	0.8911	0.8338	0.7071	0.5427	0.3746	0.2612	0.3059	0.5228	0.7722	0.8881	0.9300 (89)
MIT 2	18.5489	18.8300	19.2440	19.7590	20.0741	20.2142	20.2457	20.2407	20.1407	19.7108	19.0707	18.5055 (90)
Living area fraction									fLA = Living area /	(4) =		0.4391 (91)
MIT	18.8202	19.1040	19.5237	20.0503	20.3812	20.5315	20.5684	20.5608	20.4476	19.9943	19.3427	18.7744 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8202	19.1040	19.5237	20.0503	20.3812	20.5315	20.5684	20.5608	20.4476	19.9943	19.3427	18.7744 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9059	0.8731	0.8173	0.7001	0.5490	0.3910	0.2826	0.3285	0.5356	0.7625	0.8710	0.9135 (94)
Useful gains	312.8719	341.4381	356.5933	358.6544	314.0421	227.5817	156.0463	161.9399	230.2816	279.5569	294.4869	303.2582 (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	595.6712	581.4140	531.9446	450.7804	350.2829	237.1791	158.6812	166.0980	254.7057	379.0553	495.9219	592.7751 (97)
Space heating kWh	210.4027	161.2639	130.4613	66.3307	26.9631	0.0000	0.0000	0.0000	0.0000	74.0268	145.0332	215.4006 (98a)
Space heating requirement - total per year (kWh/year)												1029.8824
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	210.4027	161.2639	130.4613	66.3307	26.9631	0.0000	0.0000	0.0000	0.0000	74.0268	145.0332	215.4006 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1029.8824
Space heating per m2										(98c) / (4) =		20.5360 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	375.8739	295.9007	303.3871	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9105	0.9411	0.9192	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	342.2164	278.4641	278.8661	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	653.7852	620.2875	552.5627	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	224.3295	254.3166	203.6303	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fC = cooled area / (4) =											1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.0824	63.5791	50.9076	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												170.5691 (107)
Energy for space heating												20.5360 (99)
Energy for space cooling												3.4012 (108)
Total												23.9372 (109)
Fabric Energy Efficiency (DFEE)												23.9 (109)

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

1. Overall dwelling characteristics

Main dwelling		Area (m2)	Storey height (m)	Volume (m3)
Ground floor		50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		50.1500		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	120.3600 (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) =	0.1662 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.4162 (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) =										0.3537 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.4510	0.4422	0.4333	0.3891	0.3803	0.3361	0.3361	0.3272	0.3537	0.3803	0.3980	0.4156 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.6017	0.5978	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864 (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						
Main dwelling													
TER Opening Type			10.9300	1.1450	12.5153			(27)					
External Wall	36.1680	10.9300	25.2380	0.1800	4.5428			(29a)					
Total net area of external elements Aum(A, m2)			36.1680					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.0581			(33)					
Main dwelling													
Party Wall 1			31.8700	0.0000	0.0000			(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9903	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				5.2100	0.0500	0.2605							
E3 Sill				3.4000	0.0500	0.1700							
E4 Jamb				12.6000	0.0500	0.6300							
E7 Party floor between dwellings (in blocks of flats)				12.1350	0.0700	0.8495							
E16 Corner (normal)				4.8000	0.0900	0.4320							
E18 Party wall between dwellings				2.4000	0.0600	0.1440							
E7 Party floor between dwellings (in blocks of flats)				12.1350	0.0700	0.8495							
E25 Staggered party wall between dwellings				2.4000	0.0600	0.1440							
E9 Balcony between dwellings, wall insulation continuous				5.8700	0.0200	0.1174							
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				13.2800	0.0000	0.0000							
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)				13.2800	0.0000	0.0000							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.5968	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	20.6549	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 23.8992	Feb 23.7424	Mar 23.5886	Apr 22.8664	May 22.7312	Jun 22.1022	Jul 22.1022	Aug 21.9857	Sep 22.3445	Oct 22.7312	Nov 23.0046	Dec 23.2904	(38)
Heat transfer coeff	44.5541	44.3973	44.2435	43.5213	43.3861	42.7571	42.7571	42.6406	42.9994	43.3861	43.6595	43.9453	(39)
Average = Sum(39)m / 12 =												43.5206	
HLP	Jan 0.8884	Feb 0.8853	Mar 0.8822	Apr 0.8678	May 0.8651	Jun 0.8526	Jul 0.8526	Aug 0.8503	Sep 0.8574	Oct 0.8651	Nov 0.8706	Dec 0.8763	(40)
HLP (average)												0.8678	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.6945 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths												
22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	(42b)
Hot water usage for other uses												
31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	(42c)
Average daily hot water use (litres/day)												50.1746 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	54.7398	53.2388	51.5999	49.5593	47.7392	45.8476	45.4540	47.0897	48.7673	50.7099	52.7685	54.6629 (44)
Energy content (annual)	86.6945	75.8114	79.3071	67.8442	64.2661	56.3749	54.9727	58.3068	60.1349	68.8129	75.1785	85.5889 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum (45)m = 833.2930
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU 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	(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	(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												
73.6903	64.4397	67.4110	57.6676	54.6262	47.9187	46.7268	49.5608	51.1147	58.4910	63.9017	72.7506	(62)

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WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	73.6903	64.4397	67.4110	57.6676	54.6262	47.9187	46.7268	49.5608	51.1147	58.4910	63.9017	72.7506 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											708.2991 (64)
Electric shower(s)	42.1486	37.5548	41.0084	39.1338	39.8681	38.0303	39.2980	39.8681	39.1338	41.0084	40.2373	42.1486 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											479.4384 (64a)
Heat gains from water heating, kWh/month	28.9597	25.4986	27.1049	24.2003	23.6236	21.4873	21.5062	22.3572	22.5621	24.8748	26.0347	28.7248 (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	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.5099	82.4931	74.5099	76.9935	74.5099	76.9935	74.5099	74.5099	76.9935	74.5099	76.9935	74.5099 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.6235	149.1554	145.2951	137.0771	126.7033	116.9534	110.4398	108.9080	112.7682	120.9863	131.3601	141.1100 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726 (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)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807 (71)
Water heating gains (Table 5)	38.9244	37.9444	36.4313	33.6116	31.7521	29.8434	28.9062	30.0501	31.3363	33.4339	36.1594	38.6086 (72)
Total internal gains	309.4756	318.0106	304.6540	296.1000	281.3831	272.2081	262.2737	261.8857	269.5158	277.3478	292.9307	302.6462 (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					7.1300	11.2829	0.6300	0.7000			0.7700			24.5858 (75)
Northwest					3.8000	11.2829	0.6300	0.7000			0.7700			13.1032 (81)

Solar gains	37.6890	76.7170	138.2196	226.9963	305.1276	325.2983	304.3099	242.5994	168.4228	93.7543	47.4225	30.7787 (83)		
Total gains	347.1645	394.7276	442.8737	523.0963	586.5107	597.5064	566.5836	504.4850	437.9386	371.1021	340.3532	333.4249 (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	27.1989	27.2950	27.3899	27.8444	27.9311	28.3420	28.3420	28.4195	28.1823	27.9311	27.7562	27.5757
alpha	2.8133	2.8197	2.8260	2.8563	2.8621	2.8895	2.8895	2.8946	2.8788	2.8621	2.8504	2.8384
util living area	0.9339	0.9064	0.8566	0.7432	0.5916	0.4307	0.3227	0.3730	0.5861	0.8085	0.9053	0.9397 (86)
MIT	18.9460	19.2510	19.7140	20.3196	20.7209	20.9190	20.9738	20.9603	20.8016	20.2531	19.5274	18.9103 (87)
Th 2	20.1774	20.1800	20.1826	20.1949	20.1972	20.2080	20.2080	20.2100	20.2038	20.1972	20.1926	20.1877 (88)
util rest of house	0.9264	0.8960	0.8409	0.7172	0.5544	0.3836	0.2676	0.3137	0.5356	0.7821	0.8932	0.9328 (89)
MIT 2	18.2898	18.5893	19.0400	19.6206	19.9824	20.1555	20.1949	20.1891	20.0655	19.5740	18.8735	18.2622 (90)
Living area fraction	18.5779	18.8798	19.3359	19.9275	20.3066	20.4907	20.5369	20.5277	20.3887	19.8722	19.1606	18.5468 (92)
MIT	18.5779	18.8798	19.3359	19.9275	20.3066	20.4907	20.5369	20.5277	20.3887	19.8722	19.1606	18.5468 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5779	18.8798	19.3359	19.9275	20.3066	20.4907	20.5369	20.5277	20.3887	19.8722	19.1606	18.5468 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9082	0.8765	0.8224	0.7080	0.5597	0.4007	0.2908	0.3379	0.5478	0.7702	0.8747	0.9154 (94)
Ext temp.	315.2978	345.9681	364.2058	370.3513	328.2507	239.4318	164.7511	170.4796	239.8896	285.8132	297.7127	305.2245 (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	636.1400	620.6668	567.9062	479.9322	373.4092	251.8707	168.3314	176.0091	270.4092	402.2840	526.5605	630.4731 (97)
Space heating requirement - total per year (kWh/year)	238.7066	184.5975	151.5531	78.8983	33.5979	0.0000	0.0000	0.0000	0.0000	86.6543	164.7703	241.9849 (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)	238.7066	184.5975	151.5531	78.8983	33.5979	0.0000	0.0000	0.0000	0.0000	86.6543	164.7703	241.9849 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	238.7066	184.5975	151.5531	78.8983	33.5979	0.0000	0.0000	0.0000	0.0000	86.6543	164.7703	241.9849 (98c)
Space heating per m2												23.5446 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	401.9167	316.4025	324.0686	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8947	0.9287	0.9040	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	359.5929	293.8517	292.9556	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	671.8908	637.2250	566.0655	0.0000	0.0000	0.0000	0.0000 (103)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	224.8545	255.4697	203.1937	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.2136	63.8674	50.7984	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												170.8795 (107)
Energy for space heating												23.5446 (99)
Energy for space cooling												3.4074 (108)
Total												26.9520 (109)
Fabric Energy Efficiency (TFEE)												27.0 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.3600 (5)

2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												0 * 10 = 0.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans												Air changes per hour
Pressure test												0.0000 / (5) = 0.0000 (8)
Pressure Test Method												Yes
Measured/design AP50												Blower Door
Infiltration rate												3.0000 (17)
Number of sides sheltered												0.1500 (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) = 0.1275 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infiltr rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403 (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					
Main dwelling													
Windows / Glazed Doors				10.9300	1.1450	12.5153			(27)				
External Wall		36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840	(29a)				
Total net area of external elements Aum(A, m2)				36.1680					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		16.3010			(33)				
Main dwelling													
Party Wall 1				31.8700	0.0000	0.0000	20.0000	637.4000	(32)				
Party Floor 1				50.1500			30.0000	1504.5000	(32d)				
Party Ceiling 1				50.1500			20.0000	1003.0000	(32b)				
Internal Wall 1				84.8200			9.0000	763.3800	(32c)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =		4362.5640	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								86.9903	(35)				
Thermal bridges (User defined value 0.070 * total exposed area)								2.5318	(36)				
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =		18.8327	(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	10.0513	9.9247	9.7981	9.1651	9.0385	8.4055	8.4055	8.2789	8.6587	9.0385	9.2917	9.5449	(38)
Average = Sum(39)m / 12 =	28.8841	28.7575	28.6309	27.9978	27.8712	27.2382	27.2382	27.1116	27.4914	27.8712	28.1244	28.3777	(39)
												27.9662	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.5760	0.5734	0.5709	0.5583	0.5558	0.5431	0.5431	0.5406	0.5482	0.5558	0.5608	0.5659	(40)
												0.5577	

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Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6945 (42)											
Hot water usage for mixer showers	52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293 (42a)
Hot water usage for baths	22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793 (42b)
Hot water usage for other uses	31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836 (42c)
Average daily hot water use (litres/day)	98.6986 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922 (44)
Energy content (annual)	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806 (45)
Distribution loss (46)m = 0.15 x (45)m	1639.3633											
Water storage loss (or HIU loss):	25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521 (46)
Store volume	201.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.6100 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.8694 (55)											
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (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	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (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 =	1956.6943 (64)											
Heat gains from water heating, kWh/month	56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538 (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	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5606	19.1499	15.5738	11.7904	8.8134	7.4407	8.0399	10.4506	14.0267	17.8102	20.7871	22.1598 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.3336	222.6200	216.8584	204.5927	189.1094	174.5573	164.8356	162.5492	168.3108	180.5765	196.0598	210.6119 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616 (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)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807 (71)
Water heating gains (Table 5)	75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379 (72)
Total internal gains	398.6426	396.5580	383.4435	359.1158	335.5849	314.3599	301.9817	304.7953	317.2862	339.2165	365.6126	388.4616 (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				7.1300	11.2829	0.6000	0.7000	0.7700	23.4150 (75)			
Northwest				3.8000	11.2829	0.6000	0.7000	0.7700	12.4792 (81)			
Solar gains	35.8943	73.0638	131.6377	216.1870	290.5977	309.8079	289.8190	231.0470	160.4026	89.2898	45.1643	29.3131 (83)
Total gains	434.5369	469.6219	515.0812	575.3028	626.1827	624.1678	591.8007	535.8424	477.6889	428.5063	410.7769	417.7747 (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	41.9547	42.1394	42.3258	43.2827	43.4794	44.4898	44.4898	44.6976	44.0800	43.4794	43.0879	42.7034
alpha	3.7970	3.8093	3.8217	3.8855	3.8986	3.9660	3.9660	3.9798	3.9387	3.8986	3.8725	3.8469
util living area	0.8307	0.7864	0.6999	0.5554	0.4060	0.2780	0.2022	0.2322	0.3907	0.6205	0.7746	0.8425 (86)
MIT	20.3172	20.4724	20.6919	20.8908	20.9719	20.9954	20.9990	20.9983	20.9827	20.8639	20.5879	20.2948 (87)
Th 2	20.4517	20.4540	20.4563	20.4677	20.4700	20.4814	20.4814	20.4837	20.4769	20.4700	20.4654	20.4608 (88)
util rest of house	0.8187	0.7724	0.6824	0.5349	0.3842	0.2558	0.1785	0.2063	0.3625	0.5959	0.7581	0.8312 (89)
MIT 2	19.6520	19.8427	20.1083	20.3501	20.4420	20.4775	20.4808	20.4825	20.4611	20.3260	19.9965	19.6324 (90)
Living area fraction	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	0.4391 (91)
MIT	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	19.9233 (92)
Temperature adjustment	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	0.0000
adjusted MIT	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	19.9233 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8067	0.7633	0.6794	0.5395	0.3927	0.2654	0.1889	0.2176	0.3741	0.6003	0.7513	0.8189	(94)
Useful gains	350.5502	358.4552	349.9217	310.4025	245.8897	165.6429	111.7806	116.6114	178.6811	257.2123	308.6225	342.1348	(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	451.8645	437.6650	396.9540	327.2248	250.1348	166.2866	111.9034	116.8244	181.1713	277.6587	370.0105	446.1896	(97)
Space heating kWh	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167	(98a)
Space heating requirement - total per year (kWh/year)												315.6974	
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	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												315.6974	
Space heating per m2										(98c) / (4) =		6.2951	(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)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (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	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030	(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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713	(231)
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964	(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												315.6974	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												349.4100	
Water heating fuel used												559.9995	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)													
mechanical ventilation fans (SFP = 1.0000)													146.8392 (230a)
Total electricity for the above, kWh/year													146.8392 (231)
Electricity for lighting (calculated in Appendix L)													152.3068 (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													1174.8430 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price £/kWh	Fuel cost £/year
Space heating - main system 1	315.6974	16.4900	52.0585 (240)
Space heating - main system 2	0.0000	16.4900	0.0000 (241)

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Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	16.4900	92.3439 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	146.8392	16.4900	24.2138 (249)
Energy for lighting	152.3068	16.4900	25.1154 (250)
Additional standing charges			0.0000 (251)
Total energy cost			193.7316 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7330 (257)
SAP value		88.1183
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	315.6974	0.1573	49.6678 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			128.6912 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Total CO2, kg/year			171.0422 (272)
CO2 emissions per m2			3.4100 (273)
EI value			97.5912
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 120.3600 (5)
Dwelling volume			

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000 (22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750 (22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.2562	0.2562	0.2499	0.2307	0.2276	0.2148	0.2084	0.2084	0.2212	0.2371	0.2435	0.2403 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	(27)					
Windows / Glazed Doors			10.9300	1.1450	12.5153			(27)					
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840	(29a)					
Total net area of external elements Aum(A, m2)			36.1680					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		16.3010			(33)					
Main dwelling													
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000	(32)					
Party Floor 1			50.1500			30.0000	1504.5000	(32d)					
Party Ceiling 1			50.1500			20.0000	1003.0000	(32b)					
Internal Wall 1			84.8200			9.0000	763.3800	(32c)					
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		4362.5640	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9903	(35)					
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss					(33) + (36) + (36a) =		18.8327	(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	10.1779	10.1779	9.9247	9.1651	9.0385	8.5321	8.2789	8.2789	8.7853	9.4183	9.6715	9.5449	(38)
Average = Sum(39)m / 12 =	29.0107	29.0107	28.7575	27.9978	27.8712	27.3648	27.1116	27.1116	27.6180	28.2510	28.5043	28.3777	(39)
												28.0822	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.5785	0.5785	0.5734	0.5583	0.5558	0.5457	0.5406	0.5406	0.5507	0.5633	0.5684	0.5659	(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													1.6945 (42)
Hot water usage for mixer showers													
52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293	52.4293	(42a)
Hot water usage for baths													
22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	22.6793	(42b)
Hot water usage for other uses													
31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	31.9836	(42c)
Average daily hot water use (litres/day)													98.6986 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922	107.0922	(44)
Energy content (annual)	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806	(45)
Distribution loss (46)m = 0.15 x (45)m													
25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521	25.1521	(46)
Water storage loss (or HIU loss):													
Store volume													201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8694 (55)
Total storage loss													
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	(56)
If cylinder contains dedicated solar storage													
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	194.6320	(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	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(64)
													1956.6943 (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	56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538	(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	
101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
21.5606	19.1499	15.5738	11.7904	8.8134	7.4407	8.0399	10.4506	14.0267	17.8102	20.7871	22.1598	22.1598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
220.3336	222.6200	216.8584	204.5927	189.1094	174.5573	164.8356	162.5492	168.3108	180.5765	196.0598	210.6119	210.6119	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	(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)													
-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)
Water heating gains (Table 5)													
75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379	74.9379	(72)
Total internal gains	398.6426	396.5580	383.4435	359.1158	335.5849	314.3599	301.9817	304.7953	317.2862	339.2165	365.6126	388.4616	(73)

6. Solar gains													
[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	7.1300	10.0309	0.6000	0.7000	0.7700	20.8167	(75)						
Northwest	3.8000	10.0309	0.6000	0.7000	0.7700	11.0945	(81)						

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Solar gains	31.9112	69.0868	129.8554	224.9986	300.8799	312.6260	295.7190	228.2061	156.9122	83.8267	41.2172	26.6836 (83)
Total gains	430.5539	465.6448	513.2989	584.1144	636.4648	626.9859	597.7007	533.0014	474.1984	423.0432	406.8298	415.1452 (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	41.7716	41.7716	42.1394	43.2827	43.4794	44.2840	44.6976	44.6976	43.8780	42.8948	42.5138	42.7034
alpha	3.7848	3.7848	3.8093	3.8855	3.8986	3.9523	3.9798	3.9798	3.9252	3.8597	3.8343	3.8469
util living area	0.8430	0.8064	0.7300	0.5852	0.4397	0.3372	0.2755	0.3132	0.4635	0.6708	0.7967	0.8544 (86)
MIT	20.2521	20.3876	20.6162	20.8585	20.9590	20.9886	20.9959	20.9933	20.9620	20.7994	20.5124	20.2300 (87)
Th 2	20.4494	20.4494	20.4540	20.4677	20.4700	20.4792	20.4837	20.4837	20.4746	20.4631	20.4585	20.4608 (88)
util rest of house	0.8318	0.7934	0.7139	0.5659	0.4188	0.3154	0.2525	0.2876	0.4363	0.6480	0.7813	0.8439 (89)
MIT 2	19.5699	19.7353	20.0153	20.3125	20.4279	20.4684	20.4802	20.4780	20.4376	20.2458	19.8995	19.5520 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8190	0.7827	0.7086	0.5690	0.4263	0.3245	0.2624	0.2986	0.4464	0.6492	0.7726	0.8310 (94)
Useful gains	352.6023	364.4754	363.7324	332.3679	271.3557	203.4735	156.8534	159.1379	211.6706	274.6256	314.3253	344.9721 (95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000 (96)
Heat loss rate W	463.2847	456.0975	422.1356	354.2354	277.6275	205.1487	157.4274	160.0737	217.2935	304.7972	386.7634	458.2904 (97)
Space heating kWh	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98a)
Space heating requirement - total per year (kWh/year)												366.6924
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	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												366.6924
Space heating per m2												(98c) / (4) = 7.3119 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (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	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (64)
Efficiency of water heater												349.4100 (216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (217)
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030 (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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713 (231)
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964 (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)
(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)	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)	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												366.6924 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												349.4100
Water heating fuel used												559.9995 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)	
mechanical ventilation fans (SFP = 1.0000)	146.8392 (230a)
Total electricity for the above, kWh/year	146.8392 (231)
Electricity for lighting (calculated in Appendix L)	152.3068 (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	1225.8380 (238)

10a. Fuel costs - using BEDF prices (585)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	366.6924	28.4300	104.2507 (240)
Space heating - main system 2	0.0000	28.4300	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	28.4300	159.2079 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	146.8392	28.4300	41.7464 (249)
Energy for lighting	152.3068	28.4300	43.3008 (250)
Additional standing charges			0.0000 (251)
Total energy cost			348.5057 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	366.6924	0.1567	57.4601 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			136.4835 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Total CO2, kg/year			178.8345 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	366.6924	1.5801	579.4135 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	1.5218	852.2053 (278)
Space and water heating			1431.6188 (279)
Pumps, fans and electric keep-hot	146.8392	1.5128	222.1384 (281)
Energy for lighting	152.3068	1.5338	233.6133 (282)
Total Primary energy kWh/year			1887.3705 (286)

SAP 10 EPC IMPROVEMENTS

Plot 08

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

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

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

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

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current £349	Potential £349	Saving £0
Electricity			
Space heating	£146	£146	£0
Water heating	£159	£159	£0
Lighting	£43	£43	£0
Total cost of fuels	£349	£349	£0
Total cost of uses	£348	£348	£0

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Delivered energy	24 kWh/m ²	24 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.2 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m ²	4 kg/m ²	4 kg/m ²	0 kg/m ²
Primary energy	38 kWh/m ²	38 kWh/m ²	0 kWh/m ²

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.3600 (5)

2. Ventilation rate

m3 per hour												
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												0 * 10 = 0.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												0.0000 / (5) = 0.0000 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												3.0000 (17)
Infiltration rate												0.1500 (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) = 0.1275 (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)
Balanced mechanical ventilation with heat recovery	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403 (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					
Main dwelling												
Windows / Glazed Doors			10.9300	1.1450	12.5153		(27)					
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840 (29a)					
Total net area of external elements Aum(A, m2)			36.1680				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3010		(33)					
Main dwelling												
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000 (32)					
Party Floor 1			50.1500			30.0000	1504.5000 (32d)					
Party Ceiling 1			50.1500			20.0000	1003.0000 (32b)					
Internal Wall 1			84.8200			9.0000	763.3800 (32c)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4362.5640 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9903 (35)					
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	18.8327 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 10.0513	Feb 9.9247	Mar 9.7981	Apr 9.1651	May 9.0385	Jun 8.4055	Jul 8.4055	Aug 8.2789	Sep 8.6587	Oct 9.0385	Nov 9.2917	Dec 9.5449 (38)
Heat transfer coeff	28.8841	28.7575	28.6309	27.9978	27.8712	27.2382	27.2382	27.1116	27.4914	27.8712	28.1244	28.3777 (39)
Average = Sum(39)m / 12 =												27.9662
HLP	Jan 0.5760	Feb 0.5734	Mar 0.5709	Apr 0.5583	May 0.5558	Jun 0.5431	Jul 0.5431	Aug 0.5406	Sep 0.5482	Oct 0.5558	Nov 0.5608	Dec 0.5659 (40)
HLP (average)												0.5577
Days in month	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												1.6945 (42)
Hot water usage for mixer showers												
52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293 (42a)	
Hot water usage for baths												
22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793 (42b)	
Hot water usage for other uses												
31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836 (42c)	
Average daily hot water use (litres/day)												98.6986 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922 (44)
Energy content	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806 (45)
Energy content (annual)												Total = Sum(45)m = 1639.3633
Distribution loss (46)m = 0.15 x (45)m												
25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521 (46)	
Water storage loss (or HIU loss):												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage												
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (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 (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	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (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	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (64)
												Total per year (kWh/year) = Sum(64)m = 1956.6943 (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	56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538 (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	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5606	19.1499	15.5738	11.7904	8.8134	7.4407	8.0399	10.4506	14.0267	17.8102	20.7871	22.1598 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.3336	222.6200	216.8584	204.5927	189.1094	174.5573	164.8356	162.5492	168.3108	180.5765	196.0598	210.6119 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616 (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)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807 (71)
Water heating gains (Table 5)	75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379 (72)
Total internal gains	398.6426	396.5580	383.4435	359.1158	335.5849	314.3599	301.9817	304.7953	317.2862	339.2165	365.6126	388.4616 (73)

6. Solar gains

[Jan]												
	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Northeast	7.1300		11.2829		0.6000		0.7000		0.7700		23.4150 (75)	
Northwest	3.8000		11.2829		0.6000		0.7000		0.7700		12.4792 (81)	
Solar gains	35.8943	73.0638	131.6377	216.1870	290.5977	309.8079	289.8190	231.0470	160.4026	89.2898	45.1643	29.3131 (83)
Total gains	434.5369	469.6219	515.0812	575.3028	626.1827	624.1678	591.8007	535.8424	477.6889	428.5063	410.7769	417.7747 (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	41.9547	42.1394	42.3258	43.2827	43.4794	44.4898	44.4898	44.6976	44.0800	43.4794	43.0879	42.7034
alpha	3.7970	3.8093	3.8217	3.8855	3.8986	3.9660	3.9660	3.9798	3.9387	3.8986	3.8725	3.8469
util living area	0.8307	0.7864	0.6999	0.5554	0.4060	0.2780	0.2022	0.2322	0.3907	0.6205	0.7746	0.8425 (86)
MIT	20.3172	20.4724	20.6919	20.8908	20.9719	20.9954	20.9990	20.9983	20.9827	20.8639	20.5879	20.2948 (87)
Th 2	20.4517	20.4540	20.4563	20.4677	20.4700	20.4814	20.4814	20.4837	20.4769	20.4700	20.4654	20.4608 (88)
util rest of house	0.8187	0.7724	0.6824	0.5349	0.3842	0.2558	0.1785	0.2063	0.3625	0.5959	0.7581	0.8312 (89)
MIT 2	19.6520	19.8427	20.1083	20.3501	20.4420	20.4775	20.4808	20.4825	20.4611	20.3260	19.9965	19.6324 (90)
Living area fraction												FLA = Living area / (4) = 0.4391 (91)
MIT	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	19.9233 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	19.9233 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation	0.8067	0.7633	0.6794	0.5395	0.3927	0.2654	0.1889	0.2176	0.3741	0.6003	0.7513	0.8189 (94)
Useful gains	350.5502	358.4552	349.9217	310.4025	245.8897	165.6429	111.7806	116.6114	178.6811	257.2123	308.6225	342.1348 (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	451.8645	437.6650	396.9540	327.2248	250.1348	166.2866	111.9034	116.8244	181.1713	277.6587	370.0105	446.1896 (97)
Space heating kWh	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167 (98a)
Space heating requirement - total per year (kWh/year)												315.6974
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	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												315.6974
Space heating per m ²										(98c) / (4) =		6.2951 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (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	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (216)
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030 (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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713 (231)
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964 (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												315.6974 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												349.4100
Water heating fuel used												559.9995 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)	
mechanical ventilation fans (SFP = 1.0000)	146.8392 (230a)
Total electricity for the above, kWh/year	146.8392 (231)
Electricity for lighting (calculated in Appendix L)	152.3068 (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	1174.8430 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	315.6974	16.4900	52.0585 (240)
Space heating - main system 2	0.0000	16.4900	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	16.4900	92.3439 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	146.8392	16.4900	24.2138 (249)
Energy for lighting	152.3068	16.4900	25.1154 (250)
Additional standing charges			0.0000 (251)
Total energy cost			193.7316 (255)

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11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7330 (257)
SAP value		88.1183
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	315.6974	0.1573	49.6678 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			128.6912 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Total CO ₂ , kg/year			171.0422 (272)
CO ₂ emissions per m ²			3.4100 (273)
EI value			97.5912
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	120.3600 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (21)
Wind speed	Jan 5.2000 Feb 5.2000 Mar 5.0000 Apr 4.4000 May 4.3000 Jun 3.9000 Jul 3.7000 Aug 3.7000 Sep 4.1000 Oct 4.6000 Nov 4.8000 Dec 4.7000	(22)
Wind factor	1.3000 1.3000 1.2500 1.1000 1.0750 0.9750 0.9250 0.9250 1.0250 1.1500 1.2000 1.1750	(22a)
Adj infilt rate	0.1658 0.1658 0.1594 0.1403 0.1371 0.1243 0.1179 0.1179 0.1307 0.1466 0.1530 0.1498	(22b)
Balanced mechanical ventilation with heat recovery		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.9000 (23c)
Effective ac	0.2562 0.2562 0.2499 0.2307 0.2276 0.2148 0.2084 0.2084 0.2212 0.2371 0.2435 0.2403	(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
Main dwelling							
Windows / Glazed Doors			10.9300	1.1450	12.5153		(27)
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840 (29a)
Total net area of external elements Aum(A, m ²)			36.1680				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	16.3010	(33)
Main dwelling							
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000 (32)

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Party Floor 1	50.1500	30.0000	1504.5000 (32d)
Party Ceiling 1	50.1500	20.0000	1003.0000 (32b)
Internal Wall 1	84.8200	9.0000	763.3800 (32c)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 4362.5640 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 86.9903 (35)
 Thermal bridges (User defined value 0.070 * total exposed area) 2.5318 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 18.8327 (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	10.1779	10.1779	9.9247	9.1651	9.0385	8.5321	8.2789	8.2789	8.2789	9.4183	9.6715	9.5449 (38)
Average = Sum(39)m / 12 =	29.0107	29.0107	28.7575	27.9978	27.8712	27.3648	27.1116	27.1116	27.6180	28.2510	28.5043	28.3777 (39)
	28.0822											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.5785	0.5785	0.5734	0.5583	0.5558	0.5457	0.5406	0.5406	0.5507	0.5633	0.5684	0.5659 (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													1.6945 (42)
Hot water usage for mixer showers	52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293 (42a)	
Hot water usage for baths	22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793 (42b)	
Hot water usage for other uses	31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836 (42c)	
Average daily hot water use (litres/day)												98.6986 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922 (44)	
Energy content (annual)	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806 (45)	
Distribution loss (46)m = 0.15 x (45)m	25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521 (46)	
Water storage loss (or HIU loss):													
Store volume												201.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.8694 (55)	
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)	
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (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	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (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 per year (kWh/year) = Sum(64a)m =											1956.6943 (64)	
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)	
Heat gains from water heating, kWh/month	56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538 (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	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5606	19.1499	15.5738	11.7904	8.8134	7.4407	8.0399	10.4506	14.0267	17.8102	20.7871	22.1598 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.3336	222.6200	216.8584	204.5927	189.1094	174.5573	164.8356	162.5492	168.3108	180.5765	196.0598	210.6119 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616 (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)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807 (71)
Water heating gains (Table 5)	75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379 (72)
Total internal gains	398.6426	396.5580	383.4435	359.1158	335.5849	314.3599	301.9817	304.7953	317.2862	339.2165	365.6126	388.4616 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m ²	Table 6a	Specific data	Specific data	factor	W
		W/m ²	or Table 6b	or Table 6c	Table 6d	
Northeast	7.1300	10.0309	0.6000	0.7000	0.7700	20.8167 (75)
Northwest	3.8000	10.0309	0.6000	0.7000	0.7700	11.0945 (81)
Solar gains	31.9112	69.0868	129.8554	224.9986	300.8799	312.6260
Total gains	430.5539	465.6448	513.2989	584.1144	636.4648	626.9859
						597.7007
						533.0014
						474.1984
						423.0432
						406.8298
						415.1452 (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	41.7716	41.7716	42.1394	43.2827	43.4794	44.2840	44.6976	44.6976	43.8780	42.8948	42.5138	42.7034
alpha	3.7848	3.7848	3.8093	3.8855	3.8986	3.9523	3.9798	3.9798	3.9252	3.8597	3.8343	3.8469
util living area	0.8430	0.8064	0.7300	0.5852	0.4397	0.3372	0.2755	0.3132	0.4635	0.6708	0.7967	0.8544 (86)
MIT	20.2521	20.3876	20.6162	20.8585	20.9590	20.9886	20.9959	20.9933	20.9620	20.7994	20.5124	20.2300 (87)
Th 2	20.4494	20.4494	20.4540	20.4677	20.4700	20.4792	20.4837	20.4837	20.4746	20.4631	20.4585	20.4608 (88)
util rest of house	0.8318	0.7934	0.7139	0.5659	0.4188	0.3154	0.2525	0.2876	0.4363	0.6480	0.7813	0.8439 (89)
MIT 2	19.5699	19.7353	20.0153	20.3125	20.4279	20.4684	20.4802	20.4780	20.4376	20.2458	19.8995	19.5520 (90)
Living area fraction									fLA = Living area / (4) =			0.4391 (91)
MIT	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8190	0.7827	0.7086	0.5690	0.4263	0.3245	0.2624	0.2986	0.4464	0.6492	0.7726	0.8310 (94)
Useful gains	352.6023	364.4754	363.7324	332.3679	271.3557	203.4735	156.8534	159.1379	211.6706	274.6256	314.3253	344.9721 (95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000 (96)
Heat loss rate W	463.2847	456.0975	422.1356	354.2354	277.6275	205.1487	157.4274	160.0737	217.2935	304.7972	386.7634	458.2904 (97)
Space heating kWh	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98a)
Space heating requirement - total per year (kWh/year)												366.6924
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	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												366.6924
Space heating per m2										(98c) / (4) =		7.3119 (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)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (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	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)	
Space heating fuel (main heating system)	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (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)	
Space heating fuel used, main system 2												0.0000 (213)	
Water heating													
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (64)	
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (216)	
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030 (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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713 (231)	
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964 (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													366.6924 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													349.4100
Water heating fuel used													559.9995 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)													
mechanical ventilation fans (SFP = 1.0000)													146.8392 (230a)
Total electricity for the above, kWh/year													146.8392 (231)
Electricity for lighting (calculated in Appendix L)													152.3068 (232)

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

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1225.8380 (238)

10a. Fuel costs - using BEDF prices (585)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	366.6924	28.4300	104.2507 (240)
Space heating - main system 2	0.0000	28.4300	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	28.4300	159.2079 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	146.8392	28.4300	41.7464 (249)
Energy for lighting	152.3068	28.4300	43.3008 (250)
Additional standing charges			0.0000 (251)
Total energy cost			348.5057 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	366.6924	0.1567	57.4601 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			136.4835 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Total CO2, kg/year			178.8345 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	366.6924	1.5801	579.4135 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	1.5218	852.2053 (278)
Space and water heating			1431.6188 (279)
Pumps, fans and electric keep-hot	146.8392	1.5128	222.1384 (281)
Energy for lighting	152.3068	1.5338	233.6133 (282)
Total Primary energy kWh/year			1887.3705 (286)

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Plot Reference	Lean, Clean & Green - Plot 08			Issued on Date	03/12/2025
Assessment Reference	Plot 08	Plot Type Ref			
Plot Address	P08			SAP Version	10.2
SAP Rating	98 A	DER	-0.49	TER	12.83
Environmental	100 A	% DER < TER			103.82
CO ₂ Emissions (t/year)	-0.03	DFEE	23.94	TFEE	26.95
Compliance Check	See BREL	% DFEE < TFEE			11.19
% DPER < TPER	86.08	DPER	9.43	TPER	67.76
Assessor Details	Mr. Robert Buchanan			Assessor ID	DU20-0001
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)
Main dwelling			
Ground floor	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.3600 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 = 0.0000 (6a)											
Number of open flues	0 * 20 = 0.0000 (6b)											
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)											
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)											
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)											
Number of blocked chimneys	0 * 20 = 0.0000 (6f)											
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)											
Number of passive vents	0 * 10 = 0.0000 (7b)											
Number of flueless gas fires	0 * 40 = 0.0000 (7c)											
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)											
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	3.0000 (17)											
Infiltration rate	0.1500 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (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)
Balanced mechanical ventilation with heat recovery	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
If mechanical ventilation	0.5000 (23a)											
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)											
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)											
Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403 (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
Main dwelling							
Windows / Glazed Doors			10.9300	1.1450	12.5153		(27)
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840 (29a)
Total net area of external elements A _{um} (A, m ²)			36.1680				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3010		(33)
Main dwelling							
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000 (32)
Party Floor 1			50.1500			30.0000	1504.5000 (32d)
Party Ceiling 1			50.1500			20.0000	1003.0000 (32b)
Internal Wall 1			84.8200			9.0000	763.3800 (32c)
Heat capacity C _m = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 4362.5640 (34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							86.9903 (35)
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	18.8327 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.0513	9.9247	9.7981	9.1651	9.0385	8.4055	8.4055	8.2789	8.6587	9.0385	9.2917	9.5449	(38)
Heat transfer coeff	28.8841	28.7575	28.6309	27.9978	27.8712	27.2382	27.2382	27.1116	27.4914	27.8712	28.1244	28.3777	(39)
Average = Sum(39)m / 12 =												27.9662	
HLP	0.5760	0.5734	0.5709	0.5583	0.5558	0.5431	0.5431	0.5406	0.5482	0.5558	0.5608	0.5659	(40)
HLP (average)												0.5577	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6945	(42)
Hot water usage for mixer showers														
52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293	52.4293	(42a)	
Hot water usage for baths														
22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	22.6793	(42b)	
Hot water usage for other uses														
31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	31.9836	(42c)	
Average daily hot water use (litres/day)													98.6986	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922	107.0922	(44)	
Energy conte	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806	(45)	
Energy content (annual)														
Distribution loss (46)m = 0.15 x (45)m														
25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521	25.1521	(46)	
Water storage loss (or HIU loss):														
Store volume													201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6100	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8694	(55)
Total storage loss														
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	(56)	
If cylinder contains dedicated solar storage														
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month														
197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	194.6320	(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														
197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	194.6320	(64)	
12Total per year (kWh/year)													1956.6943	(64)
Electric shower(s)													1957	(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	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														
56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538	55.7538	(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	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.5099	82.4931	74.5099	76.9935	74.5099	76.9935	74.5099	74.5099	76.9935	74.5099	76.9935	74.5099	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.6235	149.1554	145.2951	137.0771	126.7033	116.9534	110.4398	108.9080	112.7682	120.9863	131.3601	141.1100	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	(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)													
	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)
Water heating gains (Table 5)													
	75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379	(72)
Total internal gains													
	346.5476	354.1024	338.4821	324.4692	306.5411	293.9746	281.7217	282.8792	292.3763	303.9918	324.7851	338.9755	(73)

6. Solar gains

[Jan]													Gains
				Area	Solar flux	g			FF	Access		W	
				m2	Table 6a	Specific data			Specific data	factor			
					W/m2	or Table 6b			or Table 6c	Table 6d			
Northeast				7.1300	11.2829	0.6000			0.7000	0.7700		23.4150	
Northwest				3.8000	11.2829	0.6000			0.7000	0.7700		(75)	
													12.4792
													(81)
Solar gains	35.8943	73.0638	131.6377	216.1870	290.5977	309.8079	289.8190	231.0470	160.4026	89.2898	45.1643	29.3131	
Total gains	382.4418	427.1662	470.1198	540.6562	597.1388	603.7826	571.5407	513.9262	452.7789	393.2815	369.9494	368.2886	
												(83)	
												(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	41.9547	42.1394	42.3258	43.2827	43.4794	44.4898	44.4898	44.6976	44.0800	43.4794	43.0879	42.7034		
alpha	3.7970	3.8093	3.8217	3.8855	3.8986	3.9660	3.9660	3.9798	3.9387	3.8986	3.8725	3.8469		
util living area														

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	0.8722	0.8227	0.7407	0.5842	0.4244	0.2872	0.2094	0.2420	0.4109	0.6610	0.8161	0.8819 (86)
MIT	20.1630	20.3717	20.6226	20.8700	20.9673	20.9949	20.9989	20.9981	20.9793	20.8301	20.4956	20.1411 (87)
Th 2	20.4517	20.4540	20.4563	20.4677	20.4700	20.4814	20.4814	20.4837	20.4769	20.4700	20.4654	20.4608 (88)
util rest of house	0.8621	0.8099	0.7239	0.5633	0.4018	0.2643	0.1848	0.2151	0.3815	0.6363	0.8011	0.8724 (89)
MIT 2	19.4640	19.7216	20.0273	20.3271	20.4372	20.4770	20.4807	20.4823	20.4580	20.2890	19.8870	19.4444 (90)
Living area fraction									fLA = Living area / (4) =			0.4391 (91)
MIT	19.7710	20.0070	20.2887	20.5655	20.6700	20.7044	20.7082	20.7088	20.6869	20.5266	20.1542	19.7503 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7710	20.0070	20.2887	20.5655	20.6700	20.7044	20.7082	20.7088	20.6869	20.5266	20.1542	19.7503 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8483	0.7987	0.7185	0.5672	0.4104	0.2742	0.1955	0.2268	0.3934	0.6390	0.7917	0.8587	(94)
Useful gains	324.4144	341.1790	337.7647	306.6657	245.0568	165.5467	111.7605	116.5696	178.1097	251.3197	292.9002	316.2336	(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	446.8643	434.4403	394.7823	326.6087	250.0037	166.2719	111.9003	116.8180	181.0825	276.6663	367.1428	441.2812	(97)
Space heating kWh	91.1027	62.6716	42.4211	14.3590	3.6805	0.0000	0.0000	0.0000	0.0000	18.8579	53.4547	93.0354	(98a)
Space heating requirement - total per year (kWh/year)												379.5829	
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	91.1027	62.6716	42.4211	14.3590	3.6805	0.0000	0.0000	0.0000	0.0000	18.8579	53.4547	93.0354	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												379.5829	
Space heating per m2										(98c) / (4) =		7.5690	(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)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (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	91.1027	62.6716	42.4211	14.3590	3.6805	0.0000	0.0000	0.0000	0.0000	18.8579	53.4547	93.0354	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	91.1027	62.6716	42.4211	14.3590	3.6805	0.0000	0.0000	0.0000	0.0000	18.8579	53.4547	93.0354	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030	(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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713	(231)
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-28.7586	-42.6522	-64.5093	-74.5536	-81.7928	-76.6873	-75.4460	-69.9308	-59.8074	-48.5311	-31.8922	-24.5821	(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	-11.4829	-26.4838	-59.9400	-104.2498	-151.2550	-157.8556	-153.6742	-121.8038	-80.7945	-41.5297	-16.1981	-8.8699	(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												379.5829	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												349.4100	
Water heating fuel used												559.9995	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)													
mechanical ventilation fans (SFP = 1.0000)												146.8392	(230a)
Total electricity for the above, kWh/year												146.8392	(231)
Electricity for lighting (calculated in Appendix L)												152.3068	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-1613.2810	(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)

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Energy used 0.0000 (237)
Total delivered energy for all uses -374.5525 (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	379.5829	0.1573	59.7079 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			138.7313 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-679.1436	0.1339	-90.9683
PV Unit electricity exported	-934.1374	0.1226	-114.5360
Total			-205.5044 (269)
Total CO2, kg/year			-24.4221 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.4900 (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	379.5829	1.5823	600.6143 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	1.5218	852.2053 (278)
Space and water heating			1452.8197 (279)
Pumps, fans and electric keep-hot	146.8392	1.5128	222.1384 (281)
Energy for lighting	152.3068	1.5338	233.6133 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-679.1436	1.4950	-1015.3269
PV Unit electricity exported	-934.1374	0.4499	-420.2713
Total			-1435.5982 (283)
Total Primary energy kWh/year			472.9732 (286)
Dwelling Primary energy Rate (DPER)			9.4300 (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)
Main dwelling	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.3600 (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) = 0.1662 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4162 (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) = 0.3537 (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	0.4510	0.4422	0.4333	0.3891	0.3803	0.3361	0.3361	0.3272	0.3537	0.3803	0.3980	0.4156 (22b)
Effective ac	0.6017	0.5978	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864 (25)

3. Heat losses and heat loss parameter

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Element				Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K			
Main dwelling													
TER Opening Type						10.9300	1.1450	12.5153			(27)		
External Wall				36.1680	10.9300	25.2380	0.1800	4.5428			(29a)		
Total net area of external elements Aum(A, m2)						36.1680					(31)		
Fabric heat loss, W/K = Sum (A x U)							(26)...(30) + (32) =	17.0581			(33)		
Main dwelling													
Party Wall 1						31.8700	0.0000	0.0000			(32)		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K										86.9903	(35)		
List of Thermal Bridges													
K1 Element							Length	Psi-value	Total				
E2 Other lintels (including other steel lintels)							5.2100	0.0500	0.2605				
E3 Sill							3.4000	0.0500	0.1700				
E4 Jamb							12.6000	0.0500	0.6300				
E7 Party floor between dwellings (in blocks of flats)							12.1350	0.0700	0.8495				
E16 Corner (normal)							4.8000	0.0900	0.4320				
E18 Party wall between dwellings							2.4000	0.0600	0.1440				
E7 Party floor between dwellings (in blocks of flats)							12.1350	0.0700	0.8495				
E25 Staggered party wall between dwellings							2.4000	0.0600	0.1440				
E9 Balcony between dwellings, wall insulation continuous							5.8700	0.0200	0.1174				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)							13.2800	0.0000	0.0000				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)							13.2800	0.0000	0.0000				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)										3.5968	(36)		
Point Thermal bridges									(36a) =	0.0000			
Total fabric heat loss									(33) + (36) + (36a) =	20.6549	(37)		
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 23.8992	Feb 23.7424	Mar 23.5886	Apr 22.8664	May 22.7312	Jun 22.1022	Jul 22.1022	Aug 21.9857	Sep 22.3445	Oct 22.7312	Nov 23.0046	Dec 23.2904	(38)
Heat transfer coeff	44.5541	44.3973	44.2435	43.5213	43.3861	42.7571	42.7571	42.6406	42.9994	43.3861	43.6595	43.9453	(39)
Average = Sum(39)m / 12 =												43.5206	
HLP	Jan 0.8884	Feb 0.8853	Mar 0.8822	Apr 0.8678	May 0.8651	Jun 0.8526	Jul 0.8526	Aug 0.8503	Sep 0.8574	Oct 0.8651	Nov 0.8706	Dec 0.8763	(40)
HLP (average)												0.8678	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													1.6945 (42)
Hot water usage for mixer showers	52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293	(42a)
Hot water usage for baths	22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	(42b)
Hot water usage for other uses	31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	(42c)
Average daily hot water use (litres/day)												98.6986	(43)
Daily hot water use	Jan 107.3708	Feb 105.0789	Mar 102.2874	Apr 98.0416	May 94.5941	Jun 90.8876	Jul 89.4625	Aug 92.2420	Sep 95.1734	Oct 99.0647	Nov 103.3759	Dec 107.0922	(44)
Energy conte	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806	(45)
Energy content (annual)										Total = Sum(45)m =		1639.3633	
Distribution loss (46)m = 0.15 x (45)m	25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521	(46)
Water storage loss (or HIU 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	216.6440	191.7166	203.8068	179.3059	173.9367	156.8488	154.7921	160.8097	162.4502	181.0247	192.3697	214.2755	(62)
WWHRS	-24.0607	-21.2795	-22.2826	-18.4509	-17.1956	-14.7144	-13.7924	-14.6668	-15.2241	-17.9475	-20.3323	-23.6151	(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	192.5833	170.4372	181.5241	160.8550	156.7412	142.1344	140.9997	146.1429	147.2261	163.0773	172.0374	190.6603	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1964.4189	(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)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													
Heat gains from water heating, kWh/month	93.8173	83.4209	89.5489	80.6996	79.6171	73.2327	73.2515	75.2524	75.0951	81.9738	85.0434	93.0297	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan 84.7259	Feb 84.7259	Mar 84.7259	Apr 84.7259	May 84.7259	Jun 84.7259	Jul 84.7259	Aug 84.7259	Sep 84.7259	Oct 84.7259	Nov 84.7259	Dec 84.7259	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.5099	82.4931	74.5099	76.9935	74.5099	76.9935	74.5099	74.5099	76.9935	74.5099	76.9935	74.5099	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.6235	149.1554	145.2951	137.0771	126.7033	116.9534	110.4398	108.9080	112.7682	120.9863	131.3601	141.1100	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	(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)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)
Water heating gains (Table 5)	126.0985	124.1382	120.3614	112.0828	107.0122	101.7120	98.4563	101.1456	104.2988	110.1799	118.1158	125.0399	(72)
Total internal gains	399.6496	407.2044	391.5841	377.5712	359.6431	344.0767	331.8238	332.9812	342.4783	357.0938	377.8872	392.0776	(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				7.1300	11.2829		0.6300		0.7000	0.7700	24.5858 (75)	
Northwest				3.8000	11.2829		0.6300		0.7000	0.7700	13.1032 (81)	
Solar gains	37.6890	76.7170	138.2196	226.9963	305.1276	325.2983	304.3099	242.5994	168.4228	93.7543	47.4225	30.7787 (83)
Total gains	437.3386	483.9214	529.8038	604.5676	664.7707	669.3750	636.1337	575.5806	510.9011	450.8481	425.3097	422.8563 (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	27.1989	27.2950	27.3899	27.8444	27.9311	28.3420	28.3420	28.4195	28.1823	27.9311	27.7562	27.5757	
alpha	2.8133	2.8197	2.8260	2.8563	2.8621	2.8895	2.8895	2.8946	2.8788	2.8621	2.8504	2.8384	
util living area	0.8935	0.8612	0.8046	0.6876	0.5401	0.3900	0.2895	0.3307	0.5228	0.7414	0.8543	0.9004 (86)	
MIT	19.2715	19.5399	19.9442	20.4527	20.7804	20.9375	20.9804	20.9711	20.8532	20.4221	19.7997	19.2419 (87)	
Th 2	20.1774	20.1800	20.1826	20.1949	20.1972	20.2080	20.2080	20.2100	20.2038	20.1972	20.1926	20.1877 (88)	
util rest of house	0.8825	0.8474	0.7857	0.6600	0.5036	0.3462	0.2394	0.2770	0.4740	0.7109	0.8379	0.8901 (89)	
MIT 2	18.1594	18.4934	18.9923	19.6088	19.9826	20.1565	20.1955	20.1907	20.0748	19.5895	18.8310	18.1295 (90)	
Living area fraction									fLA = Living area / (4) =				0.4391 (91)
MIT	18.6477	18.9529	19.4103	19.9794	20.3329	20.4994	20.5401	20.5334	20.4166	19.9551	19.2563	18.6179 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.6477	18.9529	19.4103	19.9794	20.3329	20.4994	20.5401	20.5334	20.4166	19.9551	19.2563	18.6179 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8580	0.8235	0.7657	0.6522	0.5100	0.3625	0.2606	0.2992	0.4874	0.7010	0.8158	0.8661 (94)
Useful gains	375.2566	398.5260	405.6921	394.2847	339.0182	242.6579	165.7887	172.2320	249.0264	316.0342	346.9784	366.2316 (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	639.2500	623.9093	571.1963	482.1887	374.5484	252.2427	168.4683	176.2491	271.6089	405.8806	530.7398	633.5988 (97)
Space heating kWh	196.4112	151.4575	123.1351	63.2909	26.4345	0.0000	0.0000	0.0000	0.0000	66.8457	132.3082	198.9212 (98a)
Space heating requirement - total per year (kWh/year)												958.8043
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	196.4112	151.4575	123.1351	63.2909	26.4345	0.0000	0.0000	0.0000	0.0000	66.8457	132.3082	198.9212 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												958.8043
Space heating per m2										(98c) / (4) =		19.1187 (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	196.4112	151.4575	123.1351	63.2909	26.4345	0.0000	0.0000	0.0000	0.0000	66.8457	132.3082	198.9212	(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)	212.7965	164.0927	133.4075	68.5708	28.6398	0.0000	0.0000	0.0000	0.0000	72.4222	143.3459	215.5159	(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	192.5833	170.4372	181.5241	160.8550	156.7412	142.1344	140.9997	146.1429	147.2261	163.0773	172.0374	190.6603	(64)
Efficiency of water heater													(216)
(217)m	84.1040	83.7960	83.2085	82.1510	80.9845	79.8000	79.8000	79.8000	79.8000	82.2228	83.4781	84.1550	(217)
Fuel for water heating, kWh/month	228.9825	203.3952	218.1557	195.8040	193.5446	178.1133	176.6913	183.1365	184.4939	198.3359	206.0869	226.5584	(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	15.4817	12.4200	11.1828	8.1930	6.3285	5.1705	5.7731	7.5041	9.7470	12.7887	14.4448	15.9120	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-17.2665	-25.2395	-37.6140	-43.9205	-48.8065	-46.1178	-45.5841	-42.3318	-36.8159	-29.6085	-19.3093	-14.8273	(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)	-7.2100	-15.3994	-31.0312	-47.2193	-63.0170	-63.4989	-62.7213	-52.8158	-38.3520	-22.1910	-9.6834	-5.6821	(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)

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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												1038.7912	(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												2393.2983	(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)												124.9460	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-826.2632	(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												2816.7724	(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	1038.7912	0.2100	218.1462 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2393.2983	0.2100	502.5926 (264)
Space and water heating			720.7388 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	124.9460	0.1443	18.0336 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-407.4418	0.1338	-54.5168
PV Unit electricity exported	-418.8214	0.1255	-52.5733
Total			-107.0901 (269)
Total CO2, kg/year			643.6115 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.8300 (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	1038.7912	1.1300	1173.8341 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2393.2983	1.1300	2704.4271 (278)
Space and water heating			3878.2611 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	124.9460	1.5338	191.6464 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-407.4418	1.4945	-608.9084
PV Unit electricity exported	-418.8214	0.4608	-192.9734
Total			-801.8818 (283)
Total Primary energy kWh/year			3398.1266 (286)
Target Primary Energy Rate (TPER)			67.7600 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	50.1500	x	120.3600
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		120.3600
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	120.3600

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) = 0.1662 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)

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Infiltration rate	0.3162 (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) = 0.2687 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.3426	0.3359	0.3292	0.2956	0.2889	0.2553	0.2553	0.2486	0.2687	0.2889	0.3023	0.3158 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5587	0.5564	0.5542	0.5437	0.5417	0.5326	0.5326	0.5309	0.5361	0.5417	0.5457	0.5499 (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						
Main dwelling													
Windows / Glazed Doors			10.9300	1.1450	12.5153			(27)					
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840	(29a)					
Total net area of external elements Aum(A, m2)			36.1680					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	16.3010		(33)					
Main dwelling													
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000	(32)					
Party Floor 1			50.1500			30.0000	1504.5000	(32d)					
Party Ceiling 1			50.1500			20.0000	1003.0000	(32b)					
Internal Wall 1			84.8200			9.0000	763.3800	(32c)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4362.5640	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9903	(35)					
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	18.8327	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 22.1910	Feb 22.1005	Mar 22.0117	Apr 21.5949	May 21.5169	Jun 21.1539	Jul 21.1539	Aug 21.0866	Sep 21.2937	Oct 21.5169	Nov 21.6747	Dec 21.8396	(38)
Heat transfer coeff	41.0238	40.9332	40.8445	40.4276	40.3496	39.9866	39.9866	39.9194	40.1264	40.3496	40.5074	40.6724	(39)
Average = Sum(39)m / 12 =												40.4273	
HLP	Jan 0.8180	Feb 0.8162	Mar 0.8144	Apr 0.8061	May 0.8046	Jun 0.7973	Jul 0.7973	Aug 0.7960	Sep 0.8001	Oct 0.8046	Nov 0.8077	Dec 0.8110	(40)
HLP (average)												0.8061	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6945 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	(42b)
Hot water usage for other uses	31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	(42c)
Average daily hot water use (litres/day)													50.1746 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	54.7398	53.2388	51.5999	49.5593	47.7392	45.8476	45.4540	47.0897	48.7673	50.7099	52.7685	54.6629	(44)
Energy content (annual)	86.6945	75.8114	79.3071	67.8442	64.2661	56.3749	54.9727	58.3068	60.1349	68.8129	75.1785	85.5889	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =			833.2930
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	73.6903	64.4397	67.4110	57.6676	54.6262	47.9187	46.7268	49.5608	51.1147	58.4910	63.9017	72.7506	(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	73.6903	64.4397	67.4110	57.6676	54.6262	47.9187	46.7268	49.5608	51.1147	58.4910	63.9017	72.7506	(64)
12Total per year (kWh/year)									Total per year (kWh/year) = Sum(64)m =			708.2991	(64)
Electric shower(s)	42.1486	37.5548	41.0084	39.1338	39.8681	38.0303	39.2980	39.8681	39.1338	41.0084	40.2373	42.1486	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							479.4384	(64a)
Heat gains from water heating, kWh/month	28.9597	25.4986	27.1049	24.2003	23.6236	21.4873	21.5062	22.3572	22.5621	24.8748	26.0347	28.7248	(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	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.5099	82.4931	74.5099	76.9935	74.5099	76.9935	74.5099	74.5099	76.9935	74.5099	76.9935	74.5099 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.6235	149.1554	145.2951	137.0771	126.7033	116.9534	110.4398	108.9080	112.7682	120.9863	131.3601	141.1100 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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Losses e.g. evaporation (negative values) (Table 5)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807 (71)
Water heating gains (Table 5)	38.9244	37.9444	36.4313	33.6116	31.7521	29.8434	28.9062	30.0501	31.3363	33.4339	36.1594	38.6086 (72)
Total internal gains	309.4756	318.0106	304.6540	296.1000	281.3831	272.2081	262.2737	261.8857	269.5158	277.3478	292.9307	302.6462 (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				7.1300	11.2829	0.6000	0.7000			0.7700			23.4150 (75)
Northwest				3.8000	11.2829	0.6000	0.7000			0.7700			12.4792 (81)
Solar gains	35.8943	73.0638	131.6377	216.1870	290.5977	309.8079	289.8190	231.0470	160.4026	89.2898	45.1643	29.3131	(83)
Total gains	345.3698	391.0744	436.2918	512.2870	571.9808	582.0160	552.0926	492.9327	429.9185	366.6376	338.0950	331.9593	(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	29.5395	29.6049	29.6692	29.9751	30.0331	30.3057	30.3057	30.3568	30.2001	30.0331	29.9161	29.7948	
alpha	2.9693	2.9737	2.9779	2.9983	3.0022	3.0204	3.0204	3.0238	3.0133	3.0022	2.9944	2.9863	
util living area	0.9305	0.9015	0.8493	0.7323	0.5779	0.4183	0.3117	0.3605	0.5706	0.7983	0.9002	0.9369 (86)	
MIT	19.1667	19.4540	19.8809	20.4224	20.7735	20.9367	20.9805	20.9698	20.8396	20.3564	19.6903	19.1179 (87)	
Th 2	20.2377	20.2393	20.2408	20.2480	20.2494	20.2556	20.2556	20.2568	20.2532	20.2494	20.2466	20.2438 (88)	
util rest of house	0.9230	0.8911	0.8338	0.7071	0.5427	0.3746	0.2612	0.3059	0.5228	0.7722	0.8881	0.9300 (89)	
MIT 2	18.5489	18.8300	19.2440	19.7590	20.0741	20.2142	20.2457	20.2407	20.1407	19.7108	19.0707	18.5055 (90)	
Living area fraction									fLA = Living area /	(4) =		0.4391 (91)	
MIT	18.8202	19.1040	19.5237	20.0503	20.3812	20.5315	20.5684	20.5608	20.4476	19.9943	19.3427	18.7744 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8202	19.1040	19.5237	20.0503	20.3812	20.5315	20.5684	20.5608	20.4476	19.9943	19.3427	18.7744 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9059	0.8731	0.8173	0.7001	0.5490	0.3910	0.2826	0.3285	0.5356	0.7625	0.8710	0.9135 (94)	
Useful gains	312.8719	341.4381	356.5933	358.6544	314.0421	227.5817	156.0463	161.9399	230.2816	279.5569	294.4869	303.2582 (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	595.6712	581.4140	531.9446	450.7804	350.2829	237.1791	158.6812	166.0980	254.7057	379.0553	495.9219	592.7751 (97)	
Space heating kWh	210.4027	161.2639	130.4613	66.3307	26.9631	0.0000	0.0000	0.0000	0.0000	74.0268	145.0332	215.4006 (98a)	
Space heating requirement - total per year (kWh/year)												1029.8824	
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	210.4027	161.2639	130.4613	66.3307	26.9631	0.0000	0.0000	0.0000	0.0000	74.0268	145.0332	215.4006 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1029.8824	
Space heating per m2										(98c) / (4) =		20.5360 (99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	375.8739	295.9007	303.3871	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9105	0.9411	0.9192	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	342.2164	278.4641	278.8661	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	653.7852	620.2875	552.5627	0.0000	0.0000	0.0000	0.0000 (103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	224.3295	254.3166	203.6303	0.0000	0.0000	0.0000	0.0000 (104)	
Cooled fraction									fC = cooled area /	(4) =		1.0000 (105)	
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.0824	63.5791	50.9076	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling requirement												170.5691 (107)	
Energy for space heating												20.5360 (99)	
Energy for space cooling												3.4012 (108)	
Total												23.9372 (109)	
Fabric Energy Efficiency (DFEE)												23.9 (109)	

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

1. Overall dwelling characteristics

Full SAP Calculation Printout



Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.3600 (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)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												20.0000 / (5) =	0.1662 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												5.0000 (17)	
Infiltration rate												0.4162 (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) =	0.3537 (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	0.4510	0.4422	0.4333	0.3891	0.3803	0.3361	0.3361	0.3272	0.3537	0.3803	0.3980	0.4156	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.6017	0.5978	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864	(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				
Main dwelling												
TER Opening Type				10.9300	1.1450	12.5153			(27)			
External Wall		36.1680	10.9300	25.2380	0.1800	4.5428			(29a)			
Total net area of external elements Aum(A, m2)				36.1680					(31)			
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		17.0581			(33)			
Main dwelling												
Party Wall 1				31.8700	0.0000	0.0000			(32)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								86.9903	(35)			
List of Thermal Bridges												
K1 Element					Length	Psi-value	Total					
E2 Other lintels (including other steel lintels)					5.2100	0.0500	0.2605					
E3 Sill					3.4000	0.0500	0.1700					
E4 Jamb					12.6000	0.0500	0.6300					
E7 Party floor between dwellings (in blocks of flats)					12.1350	0.0700	0.8495					
E16 Corner (normal)					4.8000	0.0900	0.4320					
E18 Party wall between dwellings					2.4000	0.0600	0.1440					
E7 Party floor between dwellings (in blocks of flats)					12.1350	0.0700	0.8495					
E25 Staggered party wall between dwellings					2.4000	0.0600	0.1440					
E9 Balcony between dwellings, wall insulation continuous					5.8700	0.0200	0.1174					
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)					13.2800	0.0000	0.0000					
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)					13.2800	0.0000	0.0000					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									3.5968 (36)			
Point Thermal bridges							(36a) =	0.0000				
Total fabric heat loss							(33) + (36) + (36a) =	20.6549	(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	23.8992	23.7424	23.5886	22.8664	22.7312	22.1022	22.1022	21.9857	22.3445	22.7312	23.0046	23.2904 (38)
	44.5541	44.3973	44.2435	43.5213	43.3861	42.7571	42.7571	42.6406	42.9994	43.3861	43.6595	43.9453 (39)
Average = Sum(39)m / 12 =												43.5206
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8884	0.8853	0.8822	0.8678	0.8651	0.8526	0.8526	0.8503	0.8574	0.8651	0.8706	0.8763 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

												1.6945 (42)
Assumed occupancy												
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	(42b)
Hot water usage for other uses												
31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	(42c)
Average daily hot water use (litres/day)												50.1746 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	54.7398	53.2388	51.5999	49.5593	47.7392	45.8476	45.4540	47.0897	48.7673	50.7099	52.7685	54.6629 (44)
Energy content (annual)	86.6945	75.8114	79.3071	67.8442	64.2661	56.3749	54.9727	58.3068	60.1349	68.8129	75.1785	85.5889 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 833.2930

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (or HIU loss):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	73.6903	64.4397	67.4110	57.6676	54.6262	47.9187	46.7268	49.5608	51.1147	58.4910	63.9017	72.7506 (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												
	73.6903	64.4397	67.4110	57.6676	54.6262	47.9187	46.7268	49.5608	51.1147	58.4910	63.9017	72.7506 (64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				708.2991 (64)
Electric shower(s)												708 (64)
	42.1486	37.5548	41.0084	39.1338	39.8681	38.0303	39.2980	39.8681	39.1338	41.0084	40.2373	42.1486 (64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				479.4384 (64a)
Heat gains from water heating, kWh/month												
	28.9597	25.4986	27.1049	24.2003	23.6236	21.4873	21.5062	22.3572	22.5621	24.8748	26.0347	28.7248 (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	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259	84.7259 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	74.5099	82.4931	74.5099	76.9935	74.5099	76.9935	74.5099	74.5099	76.9935	74.5099	76.9935	74.5099 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	147.6235	149.1554	145.2951	137.0771	126.7033	116.9534	110.4398	108.9080	112.7682	120.9863	131.3601	141.1100 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726	31.4726 (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)												
	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807 (71)
Water heating gains (Table 5)												
	38.9244	37.9444	36.4313	33.6116	31.7521	29.8434	28.9062	30.0501	31.3363	33.4339	36.1594	38.6086 (72)
Total internal gains												
	309.4756	318.0106	304.6540	296.1000	281.3831	272.2081	262.2737	261.8857	269.5158	277.3478	292.9307	302.6462 (73)

6. Solar gains

[Jan]												
			Area	Solar flux		g	FF		Access		Gains	
			m2	Table 6a	Specific data	or Table 6b	Specific data		factor		W	
				W/m2			or Table 6c		Table 6d			
Northeast			7.1300	11.2829	0.6300		0.7000		0.7700		24.5858 (75)	
Northwest			3.8000	11.2829	0.6300		0.7000		0.7700		13.1032 (81)	
Solar gains	37.6890	76.7170	138.2196	226.9963	305.1276	325.2983	304.3099	242.5994	168.4228	93.7543	47.4225	30.7787 (83)
Total gains	347.1645	394.7276	442.8737	523.0963	586.5107	597.5064	566.5836	504.4850	437.9386	371.1021	340.3532	333.4249 (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	27.1989	27.2950	27.3899	27.8444	27.9311	28.3420	28.3420	28.4195	28.1823	27.9311	27.7562	27.5757
alpha	2.8133	2.8197	2.8260	2.8563	2.8621	2.8895	2.8895	2.8946	2.8788	2.8621	2.8504	2.8384
util living area	0.9339	0.9064	0.8566	0.7432	0.5916	0.4307	0.3227	0.3730	0.5861	0.8085	0.9053	0.9397 (86)
MIT	18.9460	19.2510	19.7140	20.3196	20.7209	20.9190	20.9738	20.9603	20.8016	20.2531	19.5274	18.9103 (87)
Th 2	20.1774	20.1800	20.1826	20.1949	20.1972	20.2080	20.2080	20.2100	20.2038	20.1972	20.1926	20.1877 (88)
util rest of house	0.9264	0.8960	0.8409	0.7172	0.5544	0.3836	0.2676	0.3137	0.5356	0.7821	0.8932	0.9328 (89)
MIT 2	18.2898	18.5893	19.0400	19.6206	19.9824	20.1555	20.1949	20.1891	20.0655	19.5740	18.8735	18.2622 (90)
Living area fraction												0.4391 (91)
MIT	18.5779	18.8798	19.3359	19.9275	20.3066	20.4907	20.5369	20.5277	20.3887	19.8722	19.1606	18.5468 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5779	18.8798	19.3359	19.9275	20.3066	20.4907	20.5369	20.5277	20.3887	19.8722	19.1606	18.5468 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9082	0.8765	0.8224	0.7080	0.5597	0.4007	0.2908	0.3379	0.5478	0.7702	0.8747	0.9154 (94)
Useful gains	315.2978	345.9681	364.2058	370.3513	328.2507	239.4318	164.7511	170.4796	239.8896	285.8132	297.7127	305.2245 (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												
	636.1400	620.6668	567.9062	479.9322	373.4092	251.8707	168.3314	176.0091	270.4092	402.2840	526.5605	630.4731 (97)
Space heating kWh												
	238.7066	184.5975	151.5531	78.8983	33.5979	0.0000	0.0000	0.0000	0.0000	86.6543	164.7703	241.9849 (98a)
Space heating requirement - total per year (kWh/year)												1180.7629
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												
	238.7066	184.5975	151.5531	78.8983	33.5979	0.0000	0.0000	0.0000	0.0000	86.6543	164.7703	241.9849 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1180.7629
Space heating per m2												23.5446 (99)

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8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	401.9167	316.4025	324.0686	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8947	0.9287	0.9040	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	359.5929	293.8517	292.9556	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	671.8908	637.2250	566.0655	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	224.8545	255.4697	203.1937	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.2136	63.8674	50.7984	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												170.8795	(107)
Energy for space heating												23.5446	(99)
Energy for space cooling												3.4074	(108)
Total												26.9520	(109)
Fabric Energy Efficiency (TFEE)												27.0	(109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.3600 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infiltr rate	0.1626 0.1594 0.1562 0.1403 0.1371 0.1211 0.1211 0.1179 0.1275 0.1371 0.1434 0.1498 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.9000 (23c)
Effective ac	0.2531 0.2499 0.2467 0.2307 0.2276 0.2116 0.2116 0.2084 0.2180 0.2276 0.2339 0.2403 (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
Main dwelling							
Windows / Glazed Doors			10.9300	1.1450	12.5153		(27)
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840 (29a)
Total net area of external elements Aum(A, m ²)			36.1680				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 16.3010		(33)
Main dwelling							
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000 (32)
Party Floor 1			50.1500			30.0000	1504.5000 (32d)
Party Ceiling 1			50.1500			20.0000	1003.0000 (32b)
Internal Wall 1			84.8200			9.0000	763.3800 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4362.5640 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							86.9903 (35)
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss					(33) + (36) + (36a) =		18.8327 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.0513	9.9247	9.7981	9.1651	9.0385	8.4055	8.4055	8.2789	8.6587	9.0385	9.2917	9.5449	(38)
Heat transfer coeff	28.8841	28.7575	28.6309	27.9978	27.8712	27.2382	27.2382	27.1116	27.4914	27.8712	28.1244	28.3777	(39)
Average = Sum(39)m / 12 =												27.9662	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5760	0.5734	0.5709	0.5583	0.5558	0.5431	0.5431	0.5406	0.5482	0.5558	0.5608	0.5659	(40)
HLP (average)												0.5577	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6945 (42)
Hot water usage for mixer showers													
52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293	(42a)	
Hot water usage for baths													
22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	(42b)	
Hot water usage for other uses													
31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	(42c)	
Average daily hot water use (litres/day)												98.6986	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922	(44)	
Energy content (annual)	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1639.3633	
25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521	(46)	
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)	
If cylinder contains dedicated solar storage													
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(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	(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													
197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(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													
197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(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													
56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538	(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	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.5606	19.1499	15.5738	11.7904	8.8134	7.4407	8.0399	10.4506	14.0267	17.8102	20.7871	22.1598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.3336	222.6200	216.8584	204.5927	189.1094	174.5573	164.8356	162.5492	168.3108	180.5765	196.0598	210.6119	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	(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)													
	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)
Water heating gains (Table 5)													
	75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379	(72)
Total internal gains													
	398.6426	396.5580	383.4435	359.1158	335.5849	314.3599	301.9817	304.7953	317.2862	339.2165	365.6126	388.4616	(73)

6. Solar gains

[Jan]												
	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Northeast	7.1300		11.2829		0.6000		0.7000		0.7700		23.4150 (75)	
Northwest	3.8000		11.2829		0.6000		0.7000		0.7700		12.4792 (81)	
Solar gains	35.8943	73.0638	131.6377	216.1870	290.5977	309.8079	289.8190	231.0470	160.4026	89.2898	45.1643	29.3131 (83)
Total gains	434.5369	469.6219	515.0812	575.3028	626.1827	624.1678	591.8007	535.8424	477.6889	428.5063	410.7769	417.7747 (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	41.9547	42.1394	42.3258	43.2827	43.4794	44.4898	44.4898	44.6976	44.0800	43.4794	43.0879	42.7034
alpha	3.7970	3.8093	3.8217	3.8855	3.8986	3.9660	3.9660	3.9798	3.9387	3.8986	3.8725	3.8469
util living area												
	0.8307	0.7864	0.6999	0.5554	0.4060	0.2780	0.2022	0.2322	0.3907	0.6205	0.7746	0.8425 (86)

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MIT	20.3172	20.4724	20.6919	20.8908	20.9719	20.9954	20.9990	20.9983	20.9827	20.8639	20.5879	20.2948 (87)
Th 2	20.4517	20.4540	20.4563	20.4677	20.4700	20.4814	20.4814	20.4837	20.4769	20.4700	20.4654	20.4608 (88)
util rest of house	0.8187	0.7724	0.6824	0.5349	0.3842	0.2558	0.1785	0.2063	0.3625	0.5959	0.7581	0.8312 (89)
MIT 2	19.6520	19.8427	20.1083	20.3501	20.4420	20.4775	20.4808	20.4825	20.4611	20.3260	19.9965	19.6324 (90)
Living area fraction									fLA = Living area / (4) =			0.4391 (91)
MIT	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	19.9233 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	19.9233 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8067	0.7633	0.6794	0.5395	0.3927	0.2654	0.1889	0.2176	0.3741	0.6003	0.7513	0.8189 (94)
Useful gains	350.5502	358.4552	349.9217	310.4025	245.8897	165.6429	111.7806	116.6114	178.6811	257.2123	308.6225	342.1348 (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	451.8645	437.6650	396.9540	327.2248	250.1348	166.2866	111.9034	116.8244	181.1713	277.6587	370.0105	446.1896 (97)
Space heating kWh	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167 (98a)
Space heating requirement - total per year (kWh/year)												315.6974
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	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												315.6974
Space heating per m2										(98c) / (4) =		6.2951 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (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	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (216)
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030 (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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713 (231)
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-28.5355	-42.3172	-63.9619	-74.2462	-81.6909	-76.6873	-75.4460	-69.9308	-59.8074	-48.2992	-31.6734	-24.4056 (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	-11.7060	-26.8189	-60.4875	-104.5572	-151.3569	-157.8556	-153.6742	-121.8038	-80.7945	-41.7616	-16.4169	-9.0465 (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												315.6974 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												349.4100
Water heating fuel used												559.9995 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)												
mechanical ventilation fans (SFP = 1.0000)												146.8392 (230a)
Total electricity for the above, kWh/year												146.8392 (231)
Electricity for lighting (calculated in Appendix L)												152.3068 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1613.2810 (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												-438.4380 (238)

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10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	315.6974	16.4900	52.0585 (240)
Space heating - main system 2	0.0000	16.4900	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	16.4900	92.3439 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	146.8392	16.4900	24.2138 (249)
Energy for lighting	152.3068	16.4900	25.1154 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-677.0014	16.4900	-111.6375
PV Unit electricity exported	-936.2796	5.5900	-52.3380
Total			-163.9756 (252)
Total energy cost			29.7560 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.1126 (257)
SAP value		98.1750
SAP rating (Section 12)		98 (258)
SAP band		A

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	315.6974	0.1573	49.6678 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			128.6912 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-677.0014	0.1339	-90.6438
PV Unit electricity exported	-936.2796	0.1227	-114.9031
Total			-205.5470 (269)
Total CO2, kg/year			-34.5048 (272)
CO2 emissions per m2			-0.6900 (273)
EI value			100.4859
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	120.3600 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (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) = 0.1275 (21)

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Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
Adj infilt rate													
	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													81.9000 (23c)
Effective ac	0.2562	0.2562	0.2499	0.2307	0.2276	0.2148	0.2084	0.2084	0.2212	0.2371	0.2435	0.2403	(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					
Main dwelling													
Windows / Glazed Doors				10.9300	1.1450	12.5153			(27)				
External Wall		36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840	(29a)				
Total net area of external elements Aum(A, m2)				36.1680					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.3010				(33)				
Main dwelling													
Party Wall 1				31.8700	0.0000	0.0000	20.0000	637.4000	(32)				
Party Floor 1				50.1500			30.0000	1504.5000	(32d)				
Party Ceiling 1				50.1500			20.0000	1003.0000	(32b)				
Internal Wall 1				84.8200			9.0000	763.3800	(32c)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =		4362.5640	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								86.9903	(35)				
Thermal bridges (User defined value 0.070 * total exposed area)								2.5318	(36)				
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =		18.8327	(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	
	10.1779	10.1779	9.9247	9.1651	9.0385	8.5321	8.2789	8.2789	8.7853	9.4183	9.6715	9.5449	(38)
Heat transfer coeff	29.0107	29.0107	28.7575	27.9978	27.8712	27.3648	27.1116	27.1116	27.6180	28.2510	28.5043	28.3777	(39)
Average = Sum(39)m / 12 =												28.0822	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5785	0.5785	0.5734	0.5583	0.5558	0.5457	0.5406	0.5406	0.5507	0.5633	0.5684	0.5659	(40)
HLP (average)												0.5600	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.6945	(42)
Hot water usage for mixer showers														
	52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293	42a)	
Hot water usage for baths														
	22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	42b)	
Hot water usage for other uses														
	31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	42c)	
Average daily hot water use (litres/day)													98.6986	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922	44)	
Energy conte	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806	45)	
Energy content (annual)														
Distribution loss (46)m = 0.15 x (45)m														
	25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521	46)	
Water storage loss (or HTU loss):														
Store volume													201.0000	47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6100	48)
Temperature factor from Table 2b													0.5400	49)
Enter (49) or (54) in (55)													0.8694	55)
Total storage loss														
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	56)	
If cylinder contains dedicated solar storage														
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	61)	
Total heat required for water heating calculated for each month														
	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	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														
	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	64)	
													1956.6943	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														
	56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538	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		
	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
	21.5606	19.1499	15.5738	11.7904	8.8134	7.4407	8.0399	10.4506	14.0267	17.8102	20.7871	22.1598	67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
	220.3336	222.6200	216.8584	204.5927	189.1094	174.5573	164.8356	162.5492	168.3108	180.5765	196.0598	210.6119	68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	69)	
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	70)	

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Losses e.g. evaporation (negative values) (Table 5)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807 (71)
Water heating gains (Table 5)	75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379 (72)
Total internal gains	398.6426	396.5580	383.4435	359.1158	335.5849	314.3599	301.9817	304.7953	317.2862	339.2165	365.6126	388.4616 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast												7.1300	10.0309	0.6000	0.7000	0.7700	20.8167 (75)
Northwest												3.8000	10.0309	0.6000	0.7000	0.7700	11.0945 (81)
Solar gains	31.9112	69.0868	129.8554	224.9986	300.8799	312.6260	295.7190	228.2061	156.9122	83.8267	41.2172	26.6836 (83)					
Total gains	430.5539	465.6448	513.2989	584.1144	636.4648	626.9859	597.7007	533.0014	474.1984	423.0432	406.8298	415.1452 (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	41.7716	41.7716	42.1394	43.2827	43.4794	44.2840	44.6976	44.6976	43.8780	42.8948	42.5138	42.7034
alpha	3.7848	3.7848	3.8093	3.8855	3.8986	3.9523	3.9798	3.9798	3.9252	3.8597	3.8343	3.8469
util living area	0.8430	0.8064	0.7300	0.5852	0.4397	0.3372	0.2755	0.3132	0.4635	0.6708	0.7967	0.8544 (86)
MIT	20.2521	20.3876	20.6162	20.8585	20.9590	20.9886	20.9959	20.9933	20.9620	20.7994	20.5124	20.2300 (87)
Th 2	20.4494	20.4494	20.4540	20.4677	20.4700	20.4792	20.4837	20.4837	20.4746	20.4631	20.4585	20.4608 (88)
util rest of house	0.8318	0.7934	0.7139	0.5659	0.4188	0.3154	0.2525	0.2876	0.4363	0.6480	0.7813	0.8439 (89)
MIT 2	19.5699	19.7353	20.0153	20.3125	20.4279	20.4684	20.4802	20.4780	20.4376	20.2458	19.8995	19.5520 (90)
Living area fraction	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497 (91)
MIT	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	352.6023	364.4754	363.7324	332.3679	271.3557	203.4735	156.8534	159.1379	211.6706	274.6256	314.3253	344.9721 (95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000 (96)
Heat loss rate W	463.2847	456.0975	422.1356	354.2354	277.6275	205.1487	157.4274	160.0737	217.2935	304.7972	386.7634	458.2904 (97)
Space heating kWh	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98a)
Space heating requirement - total per year (kWh/year)	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (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	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98c)
Space heating per m2	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98c)

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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (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	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (64)
Efficiency of water heater	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (216)
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030 (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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713 (231)
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-26.1566	-41.1572	-64.4390	-76.7671	-83.5745	-77.1814	-76.3099	-69.7835	-59.3981	-47.0078	-29.8451	-22.7731 (233a)

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Current energy efficiency rating:
Current environmental impact rating:

A 98
A 100

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

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

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

Potential energy efficiency rating: A 98
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current	Potential	Saving
Electricity	£349	£349	£0
Space heating	£146	£146	£0
Water heating	£159	£159	£0
Lighting	£43	£43	£0
Generated (PV)	-£247	-£247	£0
Total cost of fuels	£102	£102	£0
Total cost of uses	£101	£101	£0
Delivered energy	-8 kWh/m²	-8 kWh/m²	0 kWh/m²
Carbon dioxide emissions	-0.0 tonnes	-0.0 tonnes	0.0 tonnes
CO2 emissions per m²	-1 kg/m²	-1 kg/m²	0 kg/m²
Primary energy	9 kWh/m²	9 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	50.1500 (1b)	x 2.4000 (2b)	= 120.3600 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 120.3600 (5)
Dwelling volume			

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1500 (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) = 0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.2531	0.2499	0.2467	0.2307	0.2276	0.2116	0.2116	0.2084	0.2180	0.2276	0.2339	0.2403 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
Windows / Glazed Doors			10.9300	1.1450	12.5153			(27)					
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840	(29a)					
Total net area of external elements Aum(A, m2)			36.1680					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3010			(33)					
Main dwelling													
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000	(32)					
Party Floor 1			50.1500			30.0000	1504.5000	(32d)					
Party Ceiling 1			50.1500			20.0000	1003.0000	(32b)					
Internal Wall 1			84.8200			9.0000	763.3800	(32c)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4362.5640	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9903	(35)					
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	18.8327	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 10.0513	Feb 9.9247	Mar 9.7981	Apr 9.1651	May 9.0385	Jun 8.4055	Jul 8.4055	Aug 8.2789	Sep 8.6587	Oct 9.0385	Nov 9.2917	Dec 9.5449	(38)
Heat transfer coeff	28.8841	28.7575	28.6309	27.9978	27.8712	27.2382	27.2382	27.1116	27.4914	27.8712	28.1244	28.3777	(39)
Average = Sum(39)m / 12 =												27.9662	
HLP	Jan 0.5760	Feb 0.5734	Mar 0.5709	Apr 0.5583	May 0.5558	Jun 0.5431	Jul 0.5431	Aug 0.5406	Sep 0.5482	Oct 0.5558	Nov 0.5608	Dec 0.5659	(40)
HLP (average)												0.5577	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													1.6945 (42)
Hot water usage for mixer showers													
52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293	52.4293	(42a)
Hot water usage for baths													
22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793	22.6793	(42b)
Hot water usage for other uses													
31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836	31.9836	(42c)
Average daily hot water use (litres/day)												98.6986	(43)
Daily hot water use	Jan 107.3708	Feb 105.0789	Mar 102.2874	Apr 98.0416	May 94.5941	Jun 90.8876	Jul 89.4625	Aug 92.2420	Sep 95.1734	Oct 99.0647	Nov 103.3759	Dec 107.0922	(44)
Energy conte	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521	25.1521	(46)
Water storage loss (or HIU loss):													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss													
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	(56)
If cylinder contains dedicated solar storage													
26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	194.6320	(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	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(64)
Total per year (kWh/year) = Sum(64)m =												1956.6943	(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	56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538	(65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
(66)m	Jan 101.6711	Feb 101.6711	Mar 101.6711	Apr 101.6711	May 101.6711	Jun 101.6711	Jul 101.6711	Aug 101.6711	Sep 101.6711	Oct 101.6711	Nov 101.6711	Dec 101.6711	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
21.5606	19.1499	15.5738	11.7904	8.8134	7.4407	8.0399	10.4506	14.0267	17.8102	20.7871	22.1598	22.1598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
220.3336	222.6200	216.8584	204.5927	189.1094	174.5573	164.8356	162.5492	168.3108	180.5765	196.0598	210.6119	210.6119	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	(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)													
-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)
Water heating gains (Table 5)													
75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379	74.9379	(72)
Total internal gains	398.6426	396.5580	383.4435	359.1158	335.5849	314.3599	301.9817	304.7953	317.2862	339.2165	365.6126	388.4616	(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	7.1300	11.2829	0.6000	0.7000	0.7700	23.4150	(75)						

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Northwest			3.8000			11.2829			0.6000			0.7000			0.7700			12.4792 (81)		
Solar gains	35.8943	73.0638	131.6377	216.1870	290.5977	309.8079	289.8190	231.0470	160.4026	89.2898	45.1643	29.3131	(83)							
Total gains	434.5369	469.6219	515.0812	575.3028	626.1827	624.1678	591.8007	535.8424	477.6889	428.5063	410.7769	417.7747	(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	41.9547	42.1394	42.3258	43.2827	43.4794	44.4898	44.4898	44.6976	44.0800	43.4794	43.0879	42.7034								
alpha	3.7970	3.8093	3.8217	3.8855	3.8986	3.9660	3.9660	3.9798	3.9387	3.8986	3.8725	3.8469								
util living area																				
	0.8307	0.7864	0.6999	0.5554	0.4060	0.2780	0.2022	0.2322	0.3907	0.6205	0.7746	0.8425	(86)							
MIT	20.3172	20.4724	20.6919	20.8908	20.9719	20.9954	20.9990	20.9983	20.9827	20.8639	20.5879	20.2948	(87)							
Th 2	20.4517	20.4540	20.4563	20.4677	20.4700	20.4814	20.4814	20.4837	20.4769	20.4700	20.4654	20.4608	(88)							
util rest of house																				
	0.8187	0.7724	0.6824	0.5349	0.3842	0.2558	0.1785	0.2063	0.3625	0.5959	0.7581	0.8312	(89)							
MIT 2	19.6520	19.8427	20.1083	20.3501	20.4420	20.4775	20.4808	20.4825	20.4611	20.3260	19.9965	19.6324	(90)							
Living area fraction																				
MIT	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	19.9233	(92)							
Temperature adjustment												0.0000								
adjusted MIT	19.9441	20.1192	20.3645	20.5875	20.6747	20.7049	20.7083	20.7090	20.6901	20.5622	20.2562	19.9233	(93)							

8. Space heating requirement																				

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec								
Utilisation	0.8067	0.7633	0.6794	0.5395	0.3927	0.2654	0.1889	0.2176	0.3741	0.6003	0.7513	0.8189	(94)							
Useful gains	350.5502	358.4552	349.9217	310.4025	245.8897	165.6429	111.7806	116.6114	178.6811	257.2123	308.6225	342.1348	(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																				
	451.8645	437.6650	396.9540	327.2248	250.1348	166.2866	111.9034	116.8244	181.1713	277.6587	370.0105	446.1896	(97)							
Space heating kWh																				
	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167	(98a)							
Space heating requirement - total per year (kWh/year)													315.6974							
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																				
	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167	(98c)							
Space heating requirement after solar contribution - total per year (kWh/year)													315.6974							
Space heating per m2										(98c) / (4) =		6.2951	(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)							
Fraction of main heating from main system 2													0.0000 (203)							
Fraction of total heating from main system 1													1.0000 (204)							
Fraction of total heating from main system 2													0.0000 (205)							
Efficiency of main space heating system 1 (in %)													100.0000 (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																				
	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167	(98)							
Space heating efficiency (main heating system 1)																				
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)							
Space heating fuel (main heating system)																				
	75.3779	53.2290	34.9920	12.1121	3.1583	0.0000	0.0000	0.0000	0.0000	15.2121	44.1994	77.4167	(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)							
Space heating fuel used, main system 2													0.0000 (213)							
Water heating																				
Water heating requirement																				
	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(64)							
Efficiency of water heater																				
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(217)							
Fuel for water heating, kWh/month																				
	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030	(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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713	(231)							
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964	(232)							
Electricity generated by PVs (Appendix M) (negative quantity)																				
(233a)m	-28.5355	-42.3172	-63.9619	-74.2462	-81.6909	-76.6873	-75.4460	-69.9308	-59.8074	-48.2992	-31.6734	-24.4056	(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	-11.7060	-26.8189	-60.4875	-104.5572	-151.3569	-157.8556	-153.6742	-121.8038	-80.7945	-41.7616	-16.4169	-9.0465	(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													315.6974 (211)							
Space heating fuel - main system 2													0.0000 (213)							
Space heating fuel - secondary													0.0000 (215)							

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Efficiency of water heater	349.4100	
Water heating fuel used	559.9995 (219)	
Space cooling fuel	0.0000 (221)	
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)		
mechanical ventilation fans (SFP = 1.0000)	146.8392 (230a)	
Total electricity for the above, kWh/year	146.8392 (231)	
Electricity for lighting (calculated in Appendix L)	152.3068 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1613.2810 (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	-438.4380 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	315.6974	16.4900	52.0585 (240)
Space heating - main system 2	0.0000	16.4900	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	16.4900	92.3439 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	146.8392	16.4900	24.2138 (249)
Energy for lighting	152.3068	16.4900	25.1154 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-677.0014	16.4900	-111.6375
PV Unit electricity exported	-936.2796	5.5900	-52.3380
Total			-163.9756 (252)
Total energy cost			29.7560 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.1126 (257)
SAP value		98.1750
SAP rating (Section 12)		98 (258)
SAP band		A

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	315.6974	0.1573	49.6678 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			128.6912 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-677.0014	0.1339	-90.6438
PV Unit electricity exported	-936.2796	0.1227	-114.9031
Total			-205.5470 (269)
Total CO2, kg/year			-34.5048 (272)
CO2 emissions per m2			-0.6900 (273)
EI value			100.4859
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	50.1500 (1b)	2.4000 (2b)	120.3600 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.1500		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 120.3600 (5)
Dwelling volume			

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 3.0000 (17)
Infiltration rate 0.1500 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000 (22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750 (22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.2562	0.2562	0.2499	0.2307	0.2276	0.2148	0.2084	0.2084	0.2212	0.2371	0.2435	0.2403 (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
Main dwelling							
Windows / Glazed Doors			10.9300	1.1450	12.5153		(27)
External Wall	36.1680	10.9300	25.2380	0.1500	3.7857	18.0000	454.2840 (29a)
Total net area of external elements Aum(A, m2)			36.1680				(31)
Fabric heat loss, W/K = Sum (A x U)					16.3010		(33)
Main dwelling							
Party Wall 1			31.8700	0.0000	0.0000	20.0000	637.4000 (32)
Party Floor 1			50.1500			30.0000	1504.5000 (32d)
Party Ceiling 1			50.1500			20.0000	1003.0000 (32b)
Internal Wall 1			84.8200			9.0000	763.3800 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 4362.5640 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9903 (35)
Thermal bridges (User defined value 0.070 * total exposed area)							2.5318 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	18.8327 (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	10.1779	10.1779	9.9247	9.1651	9.0385	8.5321	8.2789	8.2789	8.7853	9.4183	9.6715	9.5449 (38)
Heat transfer coeff	29.0107	29.0107	28.7575	27.9978	27.8712	27.3648	27.1116	27.1116	27.6180	28.2510	28.5043	28.3777 (39)
Average = Sum(39)m / 12 =												28.0822

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.5785	0.5785	0.5734	0.5583	0.5558	0.5457	0.5406	0.5406	0.5507	0.5633	0.5684	0.5659 (40)
HLP (average)												0.5600
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6945 (42)

Hot water usage for mixer showers	52.6310	51.8400	50.6875	48.4823	46.8549	45.0400	44.0085	45.1523	46.4062	48.3548	50.6073	52.4293 (42a)
Hot water usage for baths	22.7563	22.4183	21.9424	21.0649	20.4078	19.6792	19.2857	19.7583	20.2728	21.0524	21.9480	22.6793 (42b)
Hot water usage for other uses	31.9836	30.8205	29.6575	28.4944	27.3314	26.1684	26.1684	27.3314	28.4944	29.6575	30.8205	31.9836 (42c)
Average daily hot water use (litres/day)												98.6986 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3708	105.0789	102.2874	98.0416	94.5941	90.8876	89.4625	92.2420	95.1734	99.0647	103.3759	107.0922 (44)
Energy conte	170.0491	149.6309	157.2119	134.2140	127.3418	111.7569	108.1971	114.2148	117.3584	134.4298	147.2779	167.6806 (45)
Energy content (annual)										Total = Sum(45)m =		1639.3633
Distribution loss (46)m = 0.15 x (45)m	25.5074	22.4446	23.5818	20.1321	19.1013	16.7635	16.2296	17.1322	17.6038	20.1645	22.0917	25.1521 (46)
Water storage loss (or HIU loss):												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (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	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320 (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 per year (kWh/year) = Sum(64)m =												1956.6943 (64)

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Heat gains from water heating, kWh/month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
56.5413	49.7523	52.2729	44.6262	42.3412	37.1592	35.9756	37.9764	39.0217	44.6979	48.9699	55.7538	(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	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	101.6711	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5606	19.1499	15.5738	11.7904	8.8134	7.4407	8.0399	10.4506	14.0267	17.8102	20.7871	22.1598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	220.3336	222.6200	216.8584	204.5927	189.1094	174.5573	164.8356	162.5492	168.3108	180.5765	196.0598	210.6119	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	46.8616	(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)	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	-67.7807	(71)
Water heating gains (Table 5)	75.9964	74.0361	70.2593	61.9808	56.9102	51.6100	48.3542	51.0436	54.1967	60.0779	68.0138	74.9379	(72)
Total internal gains	398.6426	396.5580	383.4435	359.1158	335.5849	314.3599	301.9817	304.7953	317.2862	339.2165	365.6126	388.4616	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		Specific data g or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	7.1300				10.0309		0.6000		0.7000		0.7700		20.8167 (75)	
Northwest	3.8000				10.0309		0.6000		0.7000		0.7700		11.0945 (81)	
Solar gains	31.9112	69.0868	129.8554	224.9986	300.8799	312.6260	295.7190	228.2061	156.9122	83.8267	41.2172	26.6836	(83)	
Total gains	430.5539	465.6448	513.2989	584.1144	636.4648	626.9859	597.7007	533.0014	474.1984	423.0432	406.8298	415.1452	(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	41.7716	41.7716	42.1394	43.2827	43.4794	44.2840	44.6976	44.6976	43.8780	42.8948	42.5138	42.7034		
alpha	3.7848	3.7848	3.8093	3.8855	3.8986	3.9523	3.9798	3.9798	3.9252	3.8597	3.8343	3.8469		
util living area	0.8430	0.8064	0.7300	0.5852	0.4397	0.3372	0.2755	0.3132	0.4635	0.6708	0.7967	0.8544	(86)	
MIT	20.2521	20.3876	20.6162	20.8585	20.9590	20.9886	20.9959	20.9933	20.9620	20.7994	20.5124	20.2300	(87)	
Th 2	20.4494	20.4494	20.4540	20.4677	20.4700	20.4792	20.4837	20.4837	20.4746	20.4631	20.4585	20.4608	(88)	
util rest of house	0.8318	0.7934	0.7139	0.5659	0.4188	0.3154	0.2525	0.2876	0.4363	0.6480	0.7813	0.8439	(89)	
MIT 2	19.5699	19.7353	20.0153	20.3125	20.4279	20.4684	20.4802	20.4780	20.4376	20.2458	19.8995	19.5520	(90)	
Living area fraction									fLA = Living area / (4) =			0.4391	(91)	
MIT	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.8695	20.0217	20.2792	20.5522	20.6611	20.6968	20.7066	20.7042	20.6678	20.4889	20.1686	19.8497	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	352.6023	364.4754	363.7324	332.3679	271.3557	203.4735	156.8534	159.1379	211.6706	274.6256	314.3253	344.9721	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	463.2847	456.0975	422.1356	354.2354	277.6275	205.1487	157.4274	160.0737	217.2935	304.7972	386.7634	458.2904	(97)
Space heating kWh	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088	(98a)
Space heating requirement - total per year (kWh/year)												366.6924	
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	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												366.6924	
Space heating per m2										(98c) / (4) =		7.3119	(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)
Fraction of main heating from main system 2													0.0000	(203)
Fraction of total heating from main system 1													1.0000	(204)
Fraction of total heating from main system 2													0.0000	(205)
Efficiency of main space heating system 1 (in %)													100.0000	(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	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088	(98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)	
Space heating fuel (main heating system)	82.3477	61.5700	43.4520	15.7446	4.6662	0.0000	0.0000	0.0000	0.0000	22.4477	52.1554	84.3088	(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)	

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Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	0.0000	(215)
Space heating fuel used, main system 2													0.0000	(213)
Water heating														
Water heating requirement	197.0005	173.9741	184.1633	160.2960	154.2932	137.8389	135.1485	141.1662	143.4404	161.3812	173.3599	194.6320	(64)	
Efficiency of water heater													349.4100	(216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(217)
Fuel for water heating, kWh/month	56.3809	49.7908	52.7069	45.8762	44.1582	39.4491	38.6791	40.4013	41.0522	46.1868	49.6150	55.7030	(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	12.4713	11.2644	12.4713	12.0690	12.4713	12.0690	12.4713	12.4713	12.0690	12.4713	12.0690	12.4713	(231)	
Lighting	18.8719	15.1397	13.6316	9.9871	7.7143	6.3027	7.0373	9.1473	11.8815	15.5891	17.6079	19.3964	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-26.1566	-41.1572	-64.4390	-76.7671	-83.5745	-77.1814	-76.3099	-69.7835	-59.3981	-47.0078	-29.8451	-22.7731	(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	-9.9293	-24.8688	-59.5904	-110.9658	-159.4005	-160.9192	-158.9798	-121.1196	-79.5040	-38.4163	-14.4431	-7.9263	(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													366.6924	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													349.4100	
Water heating fuel used													559.9995	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)														
mechanical ventilation fans (SFP = 1.0000)													146.8392	(230a)
Total electricity for the above, kWh/year													146.8392	(231)
Electricity for lighting (calculated in Appendix L)													152.3068	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1620.4564	(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													-394.6184	(238)

10a. Fuel costs - using BEDF prices (585)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	366.6924	28.4300	104.2507 (240)
Space heating - main system 2	0.0000	28.4300	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	28.4300	159.2079 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	146.8392	28.4300	41.7464 (249)
Energy for lighting	152.3068	28.4300	43.3008 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-674.3932	28.4300	-191.7300
PV Unit electricity exported	-946.0632	5.8100	-54.9663
Total			-246.6963 (252)
Total energy cost			101.8095 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	366.6924	0.1567	57.4601 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	559.9995	0.1411	79.0234 (264)
Space and water heating			136.4835 (265)
Pumps, fans and electric keep-hot	146.8392	0.1387	20.3684 (267)
Energy for lighting	152.3068	0.1443	21.9826 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-674.3932	0.1336	-90.1235
PV Unit electricity exported	-946.0632	0.1222	-115.6369
Total			-205.7605 (269)
Total CO2, kg/year			-26.9259 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	366.6924	1.5801	579.4135 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	559.9995	1.5218	852.2053 (278)

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Space and water heating			1431.6188 (279)
Pumps, fans and electric keep-hot	146.8392	1.5128	222.1384 (281)
Energy for lighting	152.3068	1.5338	233.6133 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-674.3932	1.4939	-1007.4492
PV Unit electricity exported	-946.0632	0.4485	-424.3328
Total			-1431.7820 (283)
Total Primary energy kWh/year			455.5885 (286)

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Plot Reference	Lean & Clean - Plot 25			Issued on Date	03/12/2025
Assessment Reference	Type B	Plot Type Ref			
Plot Address	P01			SAP Version	10.2
SAP Rating	82 B	DER	3.69	TER	9.50
Environmental	96 A	% DER < TER			61.16
CO ₂ Emissions (t/year)	0.48	DFEE	31.62	TFEE	34.44
Compliance Check	See BREL	% DFEE < TFEE			8.20
% DPER < TPER	21.00	DPER	39.08	TPER	49.47
Assessor Details	Mr. Robert Buchanan			Assessor ID	DU20-0001
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)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 334.7220 (5)

2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												3.0000 (17)	
Infiltration rate												0.1500 (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) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												71.1000 (23c)	
Effective ac	0.3071	0.3039	0.3007	0.2847	0.2816	0.2656	0.2656	0.2624	0.2720	0.2816	0.2879	0.2943 (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
Main dwelling							
Windows / Glazed Doors			25.5700	1.1450	29.2786		(27)
Door			2.9300	1.2000	3.5160		(26)
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000 (28a)
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000 (28b)
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200 (29a)
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000 (29a)
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400 (29a)
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200 (30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600 (30)
Total net area of external elements Aum(A, m ²)			182.0300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	52.4391	(33)
Main dwelling							
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000 (32)

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GF - Internal Wall 1	84.5100	9.0000	760.5900 (32c)
FF - Internal Wall 2	94.5800	9.0000	851.2200 (32c)
SF Internal Wall 3	54.9300	9.0000	494.3700 (32c)
Internal Floor 1	46.9700	18.0000	845.4600 (32d)
Internal Floor 2	32.8800	18.0000	591.8400 (32d)
Internal Ceiling 1	46.9700	9.0000	422.7300 (32e)
Internal Ceiling 2	32.8800	9.0000	295.9200 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
 Thermal bridges (User defined value 0.070 * total exposed area)
 Point Thermal bridges
 Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 12042.6700 (34)
 93.2167 (35)
 12.7421 (36)
 (36a) = 0.0000
 (33) + (36) + (36a) = 65.1812 (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
 33.9176 33.5655 33.2134 31.4530 31.1009 29.3405 29.3405 28.9884 30.0446 31.1009 31.8051 32.5092 (38)
 Heat transfer coeff
 99.0988 98.7467 98.3946 96.6342 96.2821 94.5217 94.5217 94.1696 95.2259 96.2821 96.9863 97.6905 (39)
 Average = Sum(39)m / 12 = 96.5462

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.7671 0.7644 0.7616 0.7480 0.7453 0.7316 0.7316 0.7289 0.7371 0.7453 0.7507 0.7562 (40)
 HLP (average) 0.7473
 Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8929 (42)
 Hot water usage for mixer showers 72.7236 71.6307 70.0381 66.9910 64.7424 62.2347 60.8093 62.3898 64.1224 66.8149 69.9274 72.4449 (42a)
 Hot water usage for baths 31.3967 30.9305 30.2738 29.0631 28.1566 27.1513 26.6084 27.2604 27.9703 29.0460 30.2816 31.2906 (42b)
 Hot water usage for other uses 44.2558 42.6465 41.0372 39.4279 37.8186 36.2093 36.2093 37.8186 39.4279 41.0372 42.6465 44.2558 (42c)
 Average daily hot water use (litres/day) 136.3909 (43)
 Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 148.3761 145.2076 141.3491 135.4820 130.7175 125.5953 123.6269 127.4688 131.5206 136.8980 142.8555 147.9913 (44)
 Energy conte 234.9915 206.7737 217.2483 185.4681 175.9709 154.4341 149.5161 157.8330 162.1780 185.7693 203.5238 231.7186 (45)
 Energy content (annual) Total = Sum(45)m = 2265.4253
 Distribution loss (46)m = 0.15 x (45)m 35.2487 31.0161 32.5872 27.8202 26.3956 23.1651 22.4274 23.6749 24.3267 27.8654 30.5286 34.7578 (46)
 Water storage loss (or HIU loss):
 Store volume 250.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 1.4100 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 0.7614 (55)
 23.6034 21.3192 23.6034 22.8420 23.6034 22.8420 23.6034 23.6034 22.8420 23.6034 22.8420 23.6034 (56)
 If cylinder contains dedicated solar storage 23.6034 21.3192 23.6034 22.8420 23.6034 22.8420 23.6034 23.6034 22.8420 23.6034 22.8420 23.6034 (57)
 Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
 Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
 Total heat required for water heating calculated for each month 281.8573 249.1041 264.1141 230.8221 222.8367 199.7881 196.3819 204.6988 207.5320 232.6351 248.8778 278.5844 (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)
 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 281.8573 249.1041 264.1141 230.8221 222.8367 199.7881 196.3819 204.6988 207.5320 232.6351 248.8778 278.5844 (64)
 Total per year (kWh/year) = Sum(64)m = 2817.2323 (64)
 2817 (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 115.6273 102.6166 109.7277 97.9514 96.0030 87.6325 87.2067 89.9721 90.2074 99.2609 103.9549 114.5391 (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
 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 (66)
 Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 150.8956 167.0630 150.8956 155.9255 150.8956 155.9255 150.8956 150.8956 155.9255 150.8956 155.9255 150.8956 (67)
 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 296.7416 299.8209 292.0613 275.5420 254.6894 235.0908 221.9978 218.9185 226.6781 243.1974 264.0501 283.6486 (68)
 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 (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) -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 (71)
 Water heating gains (Table 5) 155.4130 152.7032 147.4835 136.0435 129.0362 121.7118 117.2133 120.9302 125.2880 133.4152 144.3817 153.9504 (72)
 Total internal gains 669.4432 685.9800 656.8333 633.9039 601.0141 579.1210 556.4996 557.1373 574.2845 593.9012 630.7502 654.8875 (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
Southwest	13.4600	36.7938	0.6000	0.7000	0.7700	144.1460 (77)
Northwest	12.1100	11.2829	0.6000	0.7000	0.7700	39.7694 (81)
Solar gains	183.9154	326.4857	481.7996	655.7852	788.2150	806.1275
	767.3665	664.9580	541.4828	370.2968	222.6939	155.8366 (83)

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Total gains 853.3586 1012.4658 1138.6329 1289.6891 1389.2291 1385.2485 1323.8662 1222.0953 1115.7673 964.1980 853.4441 810.7241 (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	33.7561	33.8764	33.9976	34.6170	34.7436	35.3907	35.3907	35.5230	35.1290	34.7436	34.4913	34.2427
alpha	3.2504	3.2584	3.2665	3.3078	3.3162	3.3594	3.3594	3.3682	3.3419	3.3162	3.2994	3.2828
util living area	0.9402	0.9022	0.8436	0.7289	0.5817	0.4211	0.3097	0.3474	0.5430	0.7826	0.9056	0.9475 (86)
Living	19.3716	19.7068	20.1077	20.5588	20.8318	20.9580	20.9886	20.9833	20.9010	20.5244	19.8938	19.3250
Non living	18.7784	19.1063	19.4941	19.9262	20.1711	20.2855	20.3072	20.3065	20.2395	19.9056	19.3022	18.7399
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1670	19.7068	20.1077	20.5588	20.8318	20.9580	20.9886	20.9833	20.9010	20.5244	19.8938	19.5593 (87)
Th 2	20.2820	20.2843	20.2867	20.2986	20.3010	20.3130	20.3130	20.3154	20.3082	20.3010	20.2962	20.2915 (88)
util rest of house	0.9334	0.8919	0.8277	0.7041	0.5476	0.3796	0.2628	0.2980	0.4980	0.7560	0.8939	0.9415 (89)
MIT 2	19.5128	19.1063	19.4941	19.9262	20.1711	20.2855	20.3072	20.3065	20.2395	19.9056	19.3022	18.9570 (90)
Living area fraction									fLA = Living area / (4) =			0.1221 (91)
MIT	19.5927	19.1796	19.5690	20.0034	20.2518	20.3676	20.3903	20.3891	20.3202	19.9812	19.3744	19.0305 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5927	19.1796	19.5690	20.0034	20.2518	20.3676	20.3903	20.3891	20.3202	19.9812	19.3744	19.0305 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9260	0.8733	0.8099	0.6930	0.5451	0.3830	0.2682	0.3034	0.4988	0.7426	0.8759	0.9286 (94)
Useful gains	790.2096	884.1405	922.1474	893.7052	757.2923	530.5005	355.0212	370.7294	556.5590	716.0382	747.5458	752.8155 (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	1515.4857	1410.0627	1285.9223	1072.9704	823.3841	545.1659	358.2700	375.6521	592.3265	903.2386	1190.4488	1448.7984 (97)
Space heating kWh	539.6054	353.4197	270.6485	129.0710	49.1723	0.0000	0.0000	0.0000	0.0000	139.2771	318.8902	517.8113 (98a)
Space heating requirement - total per year (kWh/year)												2317.8955
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	539.6054	353.4197	270.6485	129.0710	49.1723	0.0000	0.0000	0.0000	0.0000	139.2771	318.8902	517.8113 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2317.8955
Space heating per m2										(98c) / (4) =		17.9418 (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 %)												249.2796 (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	539.6054	353.4197	270.6485	129.0710	49.1723	0.0000	0.0000	0.0000	0.0000	139.2771	318.8902	517.8113 (98)
Space heating efficiency (main heating system 1)	249.2796	249.2796	249.2796	249.2796	249.2796	0.0000	0.0000	0.0000	0.0000	249.2796	249.2796	249.2796 (210)
Space heating fuel (main heating system)	216.4659	141.7764	108.5722	51.7776	19.7258	0.0000	0.0000	0.0000	0.0000	55.8718	127.9247	207.7231 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844 (64)
Efficiency of water heater (217)m	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600 (216)
Fuel for water heating, kWh/month	166.2286	146.9121	155.7644	136.1301	131.4206	117.8274	115.8185	120.7235	122.3944	137.1993	146.7786	164.2984 (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	37.7174	34.0674	37.7174	36.5007	37.7174	36.5007	37.7174	37.7174	36.5007	37.7174	36.5007	37.7174 (231)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817 (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												929.8375 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.5600
Water heating fuel used												1661.4958 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)	
mechanical ventilation fans (SFP = 1.0875)	444.0924 (230a)
Total electricity for the above, kWh/year	444.0924 (231)
Electricity for lighting (calculated in Appendix L)	248.7750 (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	3284.2008 (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	929.8375	0.1563	145.3618 (261)
Total CO2 associated with community systems			0.0000 (262)
Water heating (other fuel)	1661.4958	0.1410	234.2989 (264)
Space and water heating			379.6606 (265)
Pumps, fans and electric keep-hot	444.0924	0.1387	61.6011 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Total CO2, kg/year			477.1677 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6900 (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	929.8375	1.5787	1467.9471 (275)
Total CO2 associated with community systems			0.0000 (276)
Water heating (other fuel)	1661.4958	1.5214	2527.8577 (278)
Space and water heating			3995.8049 (279)
Pumps, fans and electric keep-hot	444.0924	1.5128	671.8230 (281)
Energy for lighting	248.7750	1.5338	381.5794 (282)
Total Primary energy kWh/year			5049.2073 (286)
Dwelling Primary energy Rate (DPER)			39.0800 (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)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	334.7220 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1195 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3695 (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) = 0.3141 (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	0.4004	0.3926	0.3847	0.3455	0.3376	0.2984	0.2984	0.2905	0.3141	0.3376	0.3533	0.3690 (22b)
Effective ac	0.5802	0.5771	0.5740	0.5597	0.5570	0.5445	0.5445	0.5422	0.5493	0.5570	0.5624	0.5681 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
TER Opaque door			2.9300	1.0000	2.9300			(26)					
TER Opening Type			25.5700	1.1450	29.2786			(27)					
Ground Floor			46.9700	0.1300	6.1061			(28a)					
Exposed Floor			2.3700	0.1300	0.3081			(28b)					
GF	32.3200	11.5800	20.7400	0.1800	3.7332			(29a)					
FF	26.6400	8.4900	18.1500	0.1800	3.2670			(29a)					
SF	26.1100	8.4300	17.6800	0.1800	3.1824			(29a)					
Main Roof	32.8800		32.8800	0.1100	3.6168			(30)					
Balcony Roof	14.7400		14.7400	0.1100	1.6214			(30)					
Total net area of external elements Aum(A, m2)			182.0300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0436			(33)					
Main dwelling													
Party Wall 1			55.9800	0.0000	0.0000			(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.2167	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				13.6730	0.0500		0.6837						
E3 Sill				9.5400	0.0500		0.4770						
E4 Jamb				50.1000	0.0500		2.5050						
E5 Ground floor (normal)				13.4700	0.1600		2.1552						
E6 Intermediate floor within a dwelling				14.7400	0.0000		0.0000						
E16 Corner (normal)				2.4000	0.0900		0.2160						
E18 Party wall between dwellings				26.4000	0.0600		1.5840						
E12 Gable (insulation at ceiling level)				10.8800	0.0600		0.6528						
E15 Flat roof with parapet				5.5900	0.5600		3.1304						
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0900		-0.2160						
E25 Staggered party wall between dwellings				2.4000	0.0600		0.1440						
E20 Exposed floor (normal)				1.9100	0.3200		0.6112						
E24 Eaves (insulation at ceiling level - inverted)				5.4400	0.2400		1.3056						
P1 Party wall - Ground floor				15.4800	0.0800		1.2384						
P2 Party wall - Intermediate floor within a dwelling				27.6080	0.0000		0.0000						
P4 Party wall - Roof (insulation at ceiling level)				12.1280	0.1200		1.4554						
P8 Party Wall - Exposed floor (inverted)				1.2400	0.2400		0.2976						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.2402	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	70.2838	(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	64.0856	63.7417	63.4046	61.8213	61.5250	60.1460	60.1460	59.8906	60.6772	61.5250	62.1243	62.7508	(38)
Average = Sum(39)m / 12 =	134.3694	134.0255	133.6884	132.1051	131.8089	130.4298	130.4298	130.1744	130.9610	131.8089	132.4081	133.0347	(39)
												132.1037	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0401	1.0374	1.0348	1.0226	1.0203	1.0096	1.0096	1.0076	1.0137	1.0203	1.0249	1.0298	(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													2.8929	(42)
Hot water usage for mixer showers														
72.7236	71.6307	70.0381	66.9910	64.7424	62.2347	60.8093	62.3898	64.1224	66.8149	69.9274	72.4449	72.4449	(42a)	
Hot water usage for baths														
31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906	31.2906	(42b)	
Hot water usage for other uses														
44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558	44.2558	(42c)	
Average daily hot water use (litres/day)													136.3909	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
148.3761	145.2076	141.3491	135.4820	130.7175	125.5953	123.6269	127.4688	131.5206	136.8980	142.8555	147.9913	147.9913	(44)	
Energy content (annual)	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186	(45)	
Energy content (annual)										Total = Sum(45)m =		2265.4253		
Distribution loss (46)m = 0.15 x (45)m														
35.2487	31.0161	32.5872	27.8202	26.3956	23.1651	22.4274	23.6749	24.3267	27.8654	30.5286	34.7578	34.7578	(46)	
Water storage loss (or HIU loss):														
Store volume													250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.0208	(55)
Total storage loss														
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(56)	
If cylinder contains dedicated solar storage														
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(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														
289.8982	256.3669	272.1551	238.6037	230.8777	207.5697	204.4229	212.7398	215.3136	240.6761	256.6594	286.6254	286.6254	(62)	
WWHRS	-33.2462	-29.4032	-30.7893	-25.4948	-23.7602	-20.3318	-19.0578	-20.2661	-21.0361	-24.7992	-28.0945	-32.6305	(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														
256.6521	226.9637	241.3658	213.1090	207.1175	187.2379	185.3650	192.4737	194.2775	215.8769	228.5649	253.9949	253.9949	(64)	
12Total per year (kWh/year)									Total per year (kWh/year) = Sum(64)m =			2602.9989	(64)	
Electric shower(s)												2603	(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	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														
122.0601	108.4268	116.1605	104.1766	102.4358	93.8578	93.6395	96.4049	96.4327	105.6937	110.1801	120.9719	120.9719	(65)	

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.8956	167.0630	150.8956	155.9255	150.8956	155.9255	150.8956	150.8956	155.9255	150.8956	155.9255	150.8956	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.7416	299.8209	292.0613	275.5420	254.6894	235.0908	221.9978	218.9185	226.6781	243.1974	264.0501	283.6486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	(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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	(71)
Water heating gains (Table 5)	164.0593	161.3495	156.1297	144.6898	137.6825	130.3581	125.8596	129.5765	133.9343	142.0614	153.0280	162.5966	(72)
Total internal gains	681.0894	697.6262	668.4795	645.5501	612.6603	587.7672	565.1459	565.7835	582.9308	605.5474	642.3964	666.5337	(73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF	Access		Gains
				m2	Table 6a	Table 6b	Table 6c	Table 6d	Table 6e	Table 6f	Table 6g	W
					W/m2	W/m2	W/m2	W/m2	W/m2	W/m2	W/m2	W
Southeast				13.4600	36.7938	0.6300	0.7000	0.7700	151.3533	(77)		
Northwest				12.1100	11.2829	0.6300	0.7000	0.7700	41.7579	(81)		

Solar gains	193.1112	342.8100	505.8896	688.5744	827.6258	846.4339	805.7349	698.2059	568.5569	388.8117	233.8286	163.6285 (83)
Total gains	874.2006	1040.4363	1174.3691	1334.1246	1440.2861	1434.2011	1370.8807	1263.9894	1151.4877	994.3590	876.2250	830.1622 (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	24.8954	24.9593	25.0223	25.3222	25.3791	25.6474	25.6474	25.6977	25.5434	25.3791	25.2642	25.1452		
alpha	2.6597	2.6640	2.6682	2.6881	2.6919	2.7098	2.7098	2.7132	2.7029	2.6919	2.6843	2.6763		
util living area	0.9486	0.9203	0.8769	0.7910	0.6681	0.5172	0.3947	0.4387	0.6367	0.8334	0.9236	0.9544	(86)	
MIT	18.5757	18.9411	19.4398	20.0629	20.5448	20.8388	20.9431	20.9232	20.7049	20.0639	19.2227	18.5181	(87)	
Th 2	20.0501	20.0523	20.0544	20.0646	20.0665	20.0753	20.0753	20.0770	20.0719	20.0665	20.0626	20.0586	(88)	
util rest of house	0.9418	0.9101	0.8611	0.7643	0.6262	0.4571	0.3194	0.3613	0.5786	0.8058	0.9121	0.9484	(89)	
MIT 2	17.2069	17.6666	18.2899	19.0569	19.6214	19.9450	20.0411	20.0282	19.8146	19.0772	18.0343	17.1393	(90)	
Living area fraction														
MIT	17.3740	17.8221	18.4303	19.1797	19.7341	20.0541	20.1512	20.1374	19.9233	19.1976	18.1793	17.3076	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.3740	17.8221	18.4303	19.1797	19.7341	20.0541	20.1512	20.1374	19.9233	19.1976	18.1793	17.3076	(93)	

8. Space heating requirement

Utilisation	0.9149	0.8785	0.8273	0.7353	0.6099	0.4556	0.3258	0.3666	0.5685	0.7749	0.8812	0.9231	(94)	
Useful gains	799.7876	914.0106	971.5444	980.9736	878.4657	653.4564	446.6862	463.4092	654.5670	770.5040	772.1635	766.3190	(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	1756.7416	1731.8978	1594.9398	1358.0056	1058.9654	711.3761	463.1882	486.5165	762.6272	1133.2421	1466.9944	1743.7632	(97)	
Space heating kWh	711.9738	549.6203	463.8062	271.4631	134.2917	0.0000	0.0000	0.0000	0.0000	269.8772	500.2782	727.2185	(98a)	
Space heating requirement - total per year (kWh/year)												3628.5290		
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	711.9738	549.6203	463.8062	271.4631	134.2917	0.0000	0.0000	0.0000	0.0000	269.8772	500.2782	727.2185	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3628.5290		
Space heating per m2												(98c) / (4) =	28.0868	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	711.9738	549.6203	463.8062	271.4631	134.2917	0.0000	0.0000	0.0000	0.0000	269.8772	500.2782	727.2185	(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)	771.3692	595.4716	502.4986	294.1095	145.4948	0.0000	0.0000	0.0000	0.0000	292.3913	542.0132	787.8857	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	256.6521	226.9637	241.3658	213.1090	207.1175	187.2379	185.3650	192.4737	194.2775	215.8769	228.5649	253.9949	(64)	
Efficiency of water heater (217)m	86.2234	85.9664	85.4995	84.6036	83.1134	79.8000	79.8000	79.8000	79.8000	84.5616	85.7666	79.8000	(216)	
Fuel for water heating, kWh/month	297.6595	264.0144	282.3009	251.8910	249.1986	234.6339	232.2870	241.1951	243.4556	255.2895	266.4965	294.3808	(219)	
Space cooling fuel requirement														

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(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	31.3531	25.1526	22.6472	16.5923	12.8164	10.4711	11.6915	15.1971	19.7395	25.8993	29.2532	32.2245	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.9623	-63.9234	-92.6306	-104.9853	-113.8512	-106.4195	-105.0231	-98.7849	-87.9537	-73.3874	-49.5884	-38.8034	(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	-23.8110	-50.2628	-100.2466	-151.0966	-200.3473	-201.5784	-199.2903	-168.5581	-123.2509	-72.1575	-31.8743	-18.8232	(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												3931.2340	(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												3112.8029	(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)												253.0377	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2321.6100	(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												5061.4646	(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	3931.2340	0.2100	825.5591	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3112.8029	0.2100	653.6886	(264)
Space and water heating			1479.2477	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	253.0377	0.1443	36.5212	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-980.3130	0.1344	-131.7860	
PV Unit electricity exported	-1341.2969	0.1258	-168.7108	
Total			-300.4968	(269)
Total CO2, kg/year			1227.2014	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5000	(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	3931.2340	1.1300	4442.2944	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3112.8029	1.1300	3517.4673	(278)
Space and water heating			7959.7617	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	253.0377	1.5338	388.1177	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-980.3130	1.4968	-1467.3635	
PV Unit electricity exported	-1341.2969	0.4617	-619.2763	
Total			-2086.6398	(283)
Total Primary energy kWh/year			6391.3404	(286)
Target Primary Energy Rate (TPER)			49.4700	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)	
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)	
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 334.7220 (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		4 * 10 =	40.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1195 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			3.0000 (17)
Infiltration rate			0.2695 (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) =	0.2291 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
	0.2921	0.2863	0.2806	0.2520	0.2463	0.2176	0.2176	0.2119	0.2291	0.2463	0.2577	0.2692 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5427	0.5410	0.5394	0.5317	0.5303	0.5237	0.5237	0.5224	0.5262	0.5303	0.5332	0.5362 (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					
Main dwelling												
Windows / Glazed Doors			25.5700	1.1450	29.2786			(27)				
Door			2.9300	1.2000	3.5160			(26)				
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000	(28a)				
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000	(28b)				
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200	(29a)				
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000	(29a)				
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400	(29a)				
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200	(30)				
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600	(30)				
Total net area of external elements Aum(A, m2)			182.0300					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.4391			(33)				
Main dwelling												
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000	(32)				
GF - Internal Wall 1			84.5100			9.0000	760.5900	(32c)				
FF - Internal Wall 2			94.5800			9.0000	851.2200	(32c)				
SF Internal Wall 3			54.9300			9.0000	494.3700	(32c)				
Internal Floor 1			46.9700			18.0000	845.4600	(32d)				
Internal Floor 2			32.8800			18.0000	591.8400	(32d)				
Internal Ceiling 1			46.9700			9.0000	422.7300	(32e)				
Internal Ceiling 2			32.8800			9.0000	295.9200	(32e)				
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) =				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								12042.6700 (34)				
Thermal bridges (User defined value 0.070 * total exposed area)								93.2167 (35)				
Point Thermal bridges								12.7421 (36)				
Total fabric heat loss								(33a) = 0.0000				
								(33) + (36) + (36a) = 65.1812 (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	59.9405	59.7576	59.5783	58.7360	58.5784	57.8448	57.8448	57.7089	58.1273	58.5784	58.8972	59.2305 (38)
Average = Sum(39)m / 12 =	125.1218	124.9388	124.7595	123.9172	123.7596	123.0260	123.0260	122.8901	123.3086	123.7596	124.0784	124.4117 (39)
												123.9164

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9685	0.9671	0.9657	0.9592	0.9580	0.9523	0.9523	0.9512	0.9545	0.9580	0.9604	0.9630 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8929 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906	(42b)
Hot water usage for other uses	44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558	(42c)
Average daily hot water use (litres/day)													69.3422 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.6525	73.5769	71.3110	68.4910	65.9751	63.3606	62.8176	65.0790	67.3982	70.0831	72.9281	75.5464	(44)
Energy content (annual)	119.8151	104.7726	109.6023	93.7607	88.8152	77.9092	75.9725	80.5813	83.1087	95.1022	103.8994	118.2874	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =	1151.6267		
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													

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WWHRS	101.8428	89.0567	93.1620	79.6966	75.4929	66.2229	64.5766	68.4941	70.6424	80.8368	88.3145	100.5443 (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	101.8428	89.0567	93.1620	79.6966	75.4929	66.2229	64.5766	68.4941	70.6424	80.8368	88.3145	100.5443 (64)
Total per year (kWh/year) = Sum(64)m =												978.8827 (64)
Electric shower(s)	58.2395	51.8918	56.6639	54.0737	55.0883	52.5489	54.3006	55.0883	54.0737	56.6639	55.5984	58.2395 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												662.4705 (64a)
Heat gains from water heating, kWh/month	40.0206	35.2371	37.4565	33.4426	32.6453	29.6929	29.7193	30.8956	31.1790	34.3752	35.9782	39.6959 (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	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.8956	167.0630	150.8956	155.9255	150.8956	155.9255	150.8956	150.8956	155.9255	150.8956	155.9255	150.8956 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.7416	299.8209	292.0613	275.5420	254.6894	235.0908	221.9978	218.9185	226.6781	243.1974	264.0501	283.6486 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643 (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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144 (71)
Water heating gains (Table 5)	53.7911	52.4362	50.3447	46.4480	43.8781	41.2402	39.9453	41.5264	43.3042	46.2032	49.9698	53.3547 (72)
Total internal gains	567.8212	585.7130	559.6945	544.3084	515.8560	498.6494	479.2316	477.7334	492.3007	506.6891	536.3382	554.2919 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Southeast					13.4600	36.7938	0.6000	0.7000			0.7700	144.1460 (77)
Northwest					12.1100	11.2829	0.6000	0.7000			0.7700	39.7694 (81)
Solar gains	183.9154	326.4857	481.7996	655.7852	788.2150	806.1275	767.3665	664.9580	541.4828	370.2968	222.6939	155.8366 (83)
Total gains	751.7366	912.1987	1041.4941	1200.0936	1304.0710	1304.7769	1246.5981	1142.6914	1033.7835	876.9860	759.0321	710.1285 (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	26.7354	26.7746	26.8131	26.9953	27.0297	27.1909	27.1909	27.2209	27.1286	27.0297	26.9603	26.8880
alpha	2.7824	2.7850	2.7875	2.7997	2.8020	2.8127	2.8127	2.8147	2.8086	2.8020	2.7974	2.7925
util living area	0.9620	0.9364	0.8961	0.8125	0.6894	0.5358	0.4097	0.4577	0.6621	0.8583	0.9410	0.9671 (86)
MIT	18.5937	18.9607	19.4562	20.0734	20.5545	20.8435	20.9458	20.9250	20.7054	20.0551	19.2150	18.5233 (87)
Th 2	20.1097	20.1108	20.1120	20.1175	20.1185	20.1233	20.1233	20.1242	20.1214	20.1185	20.1164	20.1143 (88)
util rest of house	0.9569	0.9282	0.8826	0.7883	0.6497	0.4773	0.3359	0.3817	0.6067	0.8342	0.9320	0.9626 (89)
MIT 2	17.8928	18.2542	18.7387	19.3328	19.7745	20.0228	20.0971	20.0860	19.9174	19.3292	18.5130	17.8265 (90)
Living area fraction	fLA = Living area / (4) =											0.1221 (91)
MIT	17.9784	18.3404	18.8262	19.4232	19.8697	20.1230	20.2007	20.1884	20.0135	19.4178	18.5987	17.9115 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9784	18.3404	18.8262	19.4232	19.8697	20.1230	20.2007	20.1884	20.0135	19.4178	18.5987	17.9115 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9405	0.9073	0.8588	0.7666	0.6376	0.4773	0.3426	0.3875	0.5993	0.8115	0.9119	0.9476 (94)
Useful gains	707.0188	827.6450	894.4592	919.9961	831.4794	622.8004	427.1234	442.7819	619.5718	711.6379	692.1606	672.9235 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
Space heating kWh	1711.4624	1679.2280	1537.8155	1304.0017	1011.0795	679.4743	442.9845	465.5572	729.1914	1091.2847	1426.7437	1705.8762 (97)
Space heating requirement - total per year (kWh/year)	747.3060	572.2637	478.6571	276.4840	133.6225	0.0000	0.0000	0.0000	0.0000	282.4572	528.8998	768.5168 (98a)
Solar heating kWh												3788.2072
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh												0.0000
Space heating requirement after solar contribution - total per year (kWh/year)	747.3060	572.2637	478.6571	276.4840	133.6225	0.0000	0.0000	0.0000	0.0000	282.4572	528.8998	768.5168 (98c)
Space heating per m2												3788.2072
										(98c) / (4) =		29.3228 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1156.4444	910.3924	933.9651	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8168	0.8699	0.8402	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	944.6164	791.9828	784.7290	0.0000	0.0000	0.0000	0.0000 (102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1460.6590	1395.5804	1277.1449	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	371.5507	449.0766	366.3574	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	371.5507	449.0766	366.3574	0.0000	0.0000	0.0000	0.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	92.8877	112.2692	91.5894	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												296.7462	(107)
Energy for space heating												29.3228	(99)
Energy for space cooling												2.2970	(108)
Total												31.6197	(109)
Fabric Energy Efficiency (DFEE)												31.6	(109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 334.7220 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1195 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3695 (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) =	0.3141 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)	
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)	
Adj infilt rate	0.4004 0.3926 0.3847 0.3455 0.3376 0.2984 0.2984 0.2905 0.3141 0.3376 0.3533 0.3690 (22b)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		0.0000 (23c)
Effective ac	0.5802 0.5771 0.5740 0.5597 0.5570 0.5445 0.5445 0.5422 0.5493 0.5570 0.5624 0.5681 (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
Main dwelling							
TER Opaque door			2.9300	1.0000	2.9300		(26)
TER Opening Type			25.5700	1.1450	29.2786		(27)
Ground Floor			46.9700	0.1300	6.1061		(28a)
Exposed Floor			2.3700	0.1300	0.3081		(28b)
GF	32.3200	11.5800	20.7400	0.1800	3.7332		(29a)
FF	26.6400	8.4900	18.1500	0.1800	3.2670		(29a)
SF	26.1100	8.4300	17.6800	0.1800	3.1824		(29a)
Main Roof	32.8800		32.8800	0.1100	3.6168		(30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214		(30)
Total net area of external elements Aum(A, m ²)			182.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0436		(33)
Main dwelling							
Party Wall 1			55.9800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							93.2167 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				13.6730	0.0500		0.6837
E3 Sill				9.5400	0.0500		0.4770
E4 Jamb				50.1000	0.0500		2.5050
E5 Ground floor (normal)				13.4700	0.1600		2.1552
E6 Intermediate floor within a dwelling				14.7400	0.0000		0.0000
E16 Corner (normal)				2.4000	0.0900		0.2160
E18 Party wall between dwellings				26.4000	0.0600		1.5840
E12 Gable (insulation at ceiling level)				10.8800	0.0600		0.6528
E15 Flat roof with parapet				5.5900	0.5600		3.1304

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E17 Corner (inverted - interna area greater than external area)	2.4000	-0.0900	-0.2160										
E25 Staggered party wall between dwellings	2.4000	0.0600	0.1440										
E20 Exposed floor (normal)	1.9100	0.3200	0.6112										
E24 Eaves (insulation at ceiling level - inverted)	5.4400	0.2400	1.3056										
P1 Party wall - Ground floor	15.4800	0.0800	1.2384										
P2 Party wall - Intermediate floor within a dwelling	27.6080	0.0000	0.0000										
P4 Party wall - Roof (insulation at ceiling level)	12.1280	0.1200	1.4554										
P8 Party Wall - Exposed floor (inverted)	1.2400	0.2400	0.2976										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				16.2402 (36)									
Point Thermal bridges			(36a) =	0.0000									
Total fabric heat loss		(33) + (36) + (36a) =		70.2838 (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	64.0856	63.7417	63.4046	61.8213	61.5250	60.1460	60.1460	59.8906	60.6772	61.5250	62.1243	62.7508	(38)
Average = Sum(39)m / 12 =	134.3694	134.0255	133.6884	132.1051	131.8089	130.4298	130.4298	130.1744	130.9610	131.8089	132.4081	133.0347	(39)
												132.1037	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0401	1.0374	1.0348	1.0226	1.0203	1.0096	1.0096	1.0076	1.0137	1.0203	1.0249	1.0298	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8929 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906	(42b)
Hot water usage for other uses	44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558	(42c)
Average daily hot water use (litres/day)												69.3422	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	75.6525	73.5769	71.3110	68.4910	65.9751	63.3606	62.8176	65.0790	67.3982	70.0831	72.9281	75.5464	(44)
Energy content (annual)	119.8151	104.7726	109.6023	93.7607	88.8152	77.9092	75.9725	80.5813	83.1087	95.1022	103.8994	118.2874	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1151.6267	
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
WWHRS	101.8428	89.0567	93.1620	79.6966	75.4929	66.2229	64.5766	68.4941	70.6424	80.8368	88.3145	100.5443	(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	101.8428	89.0567	93.1620	79.6966	75.4929	66.2229	64.5766	68.4941	70.6424	80.8368	88.3145	100.5443	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				978.8827	(64)
Electric shower(s)	58.2395	51.8918	56.6639	54.0737	55.0883	52.5489	54.3006	55.0883	54.0737	56.6639	55.5984	58.2395	(64a)
Heat gains from water heating, kWh/month	40.0206	35.2371	37.4565	33.4426	32.6453	29.6929	29.7193	30.8956	31.1790	34.3752	35.9782	39.6959	(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	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	150.8956	167.0630	150.8956	155.9255	150.8956	155.9255	150.8956	150.8956	155.9255	150.8956	155.9255	150.8956	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	296.7416	299.8209	292.0613	275.5420	254.6894	235.0908	221.9978	218.9185	226.6781	243.1974	264.0501	283.6486	(68)
Pumps, fans	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	(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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	(71)
Total internal gains	53.7911	52.4362	50.3447	46.4480	43.8781	41.2402	39.9453	41.5264	43.3042	46.2032	49.9698	53.3547	(72)
	567.8212	585.7130	559.6945	544.3084	515.8560	498.6494	479.2316	477.7334	492.3007	506.6891	536.3382	554.2919	(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		
-----	-----				-----	-----	-----	-----	-----	-----		
Southest					13.4600	36.7938	0.6300	0.7000	0.7700	151.3533 (77)		
Northwest					12.1100	11.2829	0.6300	0.7000	0.7700	41.7579 (81)		
-----	-----				-----	-----	-----	-----	-----	-----		
Solar gains	193.1112	342.8100	505.8896	688.5744	827.6258	846.4339	805.7349	698.2059	568.5569	388.8117	233.8286	163.6285 (83)
Total gains	760.9324	928.5230	1065.5841	1232.8828	1343.4817	1345.0833	1284.9664	1175.9393	1060.8576	895.5008	770.1668	717.9203 (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	24.8954	24.9593	25.0223	25.3222	25.3791	25.6474	25.6474	25.6977	25.5434	25.3791	25.2642	25.1452
alpha	2.6597	2.6640	2.6682	2.6881	2.6919	2.7098	2.7098	2.7132	2.7029	2.6919	2.6843	2.6763
util living area	0.9620	0.9369	0.8973	0.8154	0.6949	0.5427	0.4173	0.4656	0.6691	0.8609	0.9415	0.9670 (86)
MIT	18.4091	18.7908	19.3134	19.9766	20.4955	20.8183	20.9348	20.9110	20.6645	19.9643	19.0777	18.3494 (87)
Th 2	20.0501	20.0523	20.0544	20.0646	20.0665	20.0753	20.0753	20.0770	20.0719	20.0665	20.0626	20.0586 (88)
util rest of house	0.9568	0.9284	0.8835	0.7905	0.6538	0.4814	0.3389	0.3852	0.6116	0.8363	0.9323	0.9624 (89)
MIT 2	17.6711	18.0475	18.5595	19.2014	19.6791	19.9599	20.0445	20.0324	19.8413	19.2052	18.3420	17.6178 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.7612	18.1382	18.6515	19.2961	19.7788	20.0647	20.1532	20.1397	19.9418	19.2979	18.4318	17.7071 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.7612	18.1382	18.6515	19.2961	19.7788	20.0647	20.1532	20.1397	19.9418	19.2979	18.4318	17.7071 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9395	0.9063	0.8581	0.7669	0.6400	0.4807	0.3458	0.3909	0.6028	0.8119	0.9111	0.9466 (94)
Useful gains	714.9309	841.5571	914.3765	945.4945	859.7819	646.5351	444.3162	459.7216	639.4389	727.0187	701.7277	679.6090 (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	1808.7688	1774.2604	1624.5127	1373.3745	1064.8522	712.7561	463.4382	486.8115	765.0474	1146.4561	1500.4281	1796.9145 (97)
Space heating kWh	813.8154	626.7766	528.3413	308.0736	152.5723	0.0000	0.0000	0.0000	0.0000	312.0614	575.0643	831.2753 (98a)
Space heating requirement - total per year (kWh/year)												4147.9802
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	813.8154	626.7766	528.3413	308.0736	152.5723	0.0000	0.0000	0.0000	0.0000	312.0614	575.0643	831.2753 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4147.9802
Space heating per m2	(98c) / (4) =											32.1076 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1226.0403	965.1807	989.3258	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8009	0.8559	0.8248	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	981.9170	826.0758	816.0122	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1507.7703	1440.4265	1316.0061	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	378.6144	457.0770	371.9954	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fC = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	94.6536	114.2692	92.9989	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												301.9217 (107)
Energy for space heating												32.1076 (99)
Energy for space cooling												2.3370 (108)
Total												34.4446 (109)
Fabric Energy Efficiency (TFEE)												34.4 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)	
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)	
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	334.7220 (5)	

2. Ventilation rate

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

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 3.0000 (17)
Infiltration rate 0.1500 (18)
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												71.1000 (23c)
Effective ac	0.3071	0.3039	0.3007	0.2847	0.2816	0.2656	0.2656	0.2624	0.2720	0.2816	0.2879	0.2943 (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
Main dwelling							
Windows / Glazed Doors			25.5700	1.1450	29.2786		(27)
Door			2.9300	1.2000	3.5160		(26)
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000 (28a)
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000 (28b)
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200 (29a)
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000 (29a)
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400 (29a)
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200 (30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600 (30)
Total net area of external elements Aum(A, m2)			182.0300				(31)
Fabric heat loss, W/K = Sum (A x U)					52.4391		(33)
Main dwelling							
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000 (32)
GF - Internal Wall 1			84.5100			9.0000	760.5900 (32c)
FF - Internal Wall 2			94.5800			9.0000	851.2200 (32c)
SF Internal Wall 3			54.9300			9.0000	494.3700 (32c)
Internal Floor 1			46.9700			18.0000	845.4600 (32d)
Internal Floor 2			32.8800			18.0000	591.8400 (32d)
Internal Ceiling 1			46.9700			9.0000	422.7300 (32e)
Internal Ceiling 2			32.8800			9.0000	295.9200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12042.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 93.2167 (35)
Thermal bridges (User defined value 0.070 * total exposed area) 12.7421 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 65.1812 (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
33.9176 33.5655 33.2134 31.4530 31.1009 29.3405 29.3405 28.9884 30.0446 31.1009 31.8051 32.5092 (38)
Heat transfer coeff 99.0988 98.7467 98.3946 96.6342 96.2821 94.5217 94.5217 94.1696 95.2259 96.2821 96.9863 97.6905 (39)
Average = Sum(39)m / 12 = 96.5462

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7671	0.7644	0.7616	0.7480	0.7453	0.7316	0.7316	0.7289	0.7371	0.7453	0.7507	0.7562 (40)
HLP (average)												0.7473
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8929 (42)
Hot water usage for mixer showers 72.7236 71.6307 70.0381 66.9910 64.7424 62.2347 60.8093 62.3898 64.1224 66.8149 69.9274 72.4449 (42a)
Hot water usage for baths 31.3967 30.9305 30.2738 29.0631 28.1566 27.1513 26.6084 27.2604 27.9703 29.0460 30.2816 31.2906 (42b)
Hot water usage for other uses 44.2558 42.6465 41.0372 39.4279 37.8186 36.2093 36.2093 37.8186 39.4279 41.0372 42.6465 44.2558 (42c)
Average daily hot water use (litres/day) 136.3909 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.3761	145.2076	141.3491	135.4820	130.7175	125.5953	123.6269	127.4688	131.5206	136.8980	142.8555	147.9913 (44)
Energy conte	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186 (45)
Energy content (annual)												2265.4253
Distribution loss (46)m = 0.15 x (45)m	35.2487	31.0161	32.5872	27.8202	26.3956	23.1651	22.4274	23.6749	24.3267	27.8654	30.5286	34.7578 (46)
Water storage loss (or HIU loss):												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034 (56)
If cylinder contains dedicated solar storage	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844 (64)
Total per year (kWh/year) = Sum(64)m =												2817.2323 (64)

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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 =												
Heat gains from water heating, kWh/month	115.6273	102.6166	109.7277	97.9514	96.0030	87.6325	87.2067	89.9721	90.2074	99.2609	103.9549	114.5391 (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	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.2167	31.2791	25.4379	19.2581	14.3957	12.1534	13.1322	17.0698	22.9110	29.0908	33.9532	36.1955 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.8980	447.4939	435.9124	411.2567	380.1334	350.8818	331.3400	326.7441	338.3256	362.9812	394.1046	423.3561 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500 (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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144 (71)
Water heating gains (Table 5)	155.4130	152.7032	147.4835	136.0435	129.0362	121.7118	117.2133	120.9302	125.2880	133.4152	144.3817	153.9504 (72)
Total internal gains	746.6349	744.5835	721.9410	679.6656	636.6725	597.8543	574.7928	577.8513	599.6318	638.5944	685.5468	726.6092 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				13.4600	36.7938	0.6000	0.7000	0.7700	144.1460 (77)			
Northwest				12.1100	11.2829	0.6000	0.7000	0.7700	39.7694 (81)			

Solar gains	183.9154	326.4857	481.7996	655.7852	788.2150	806.1275	767.3665	664.9580	541.4828	370.2968	222.6939	155.8366 (83)
Total gains	930.5503	1071.0692	1203.7406	1335.4508	1424.8875	1403.9818	1342.1593	1242.8093	1141.1146	1008.8913	908.2406	882.4458 (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	33.7561	33.8764	33.9976	34.6170	34.7436	35.3907	35.3907	35.5230	35.1290	34.7436	34.4913	34.2427
alpha	3.2504	3.2584	3.2665	3.3078	3.3162	3.3594	3.3594	3.3682	3.3419	3.3162	3.2994	3.2828
util living area	0.9263	0.8893	0.8260	0.7145	0.5706	0.4160	0.3057	0.3420	0.5333	0.7654	0.8915	0.9352 (86)
Living	19.4855	19.7815	20.1724	20.5859	20.8412	20.9595	20.9891	20.9841	20.9063	20.5584	19.9646	19.4345
Non living	18.8891	19.1778	19.5545	19.9502	20.1787	20.2865	20.3074	20.3069	20.2433	19.9356	19.3696	18.8467
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2252	19.7815	20.1724	20.5859	20.8412	20.9595	20.9891	20.9841	20.9063	20.5584	19.9646	19.6535 (87)
Th 2	20.2820	20.2843	20.2867	20.2986	20.3010	20.3130	20.3130	20.3154	20.3082	20.3010	20.2962	20.2915 (88)
util rest of house	0.9182	0.8780	0.8091	0.6893	0.5367	0.3749	0.2593	0.2932	0.4887	0.7379	0.8786	0.9280 (89)
MIT 2	19.5694	19.1778	19.5545	19.9502	20.1787	20.2865	20.3074	20.3069	20.2433	19.9356	19.3696	19.0488 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.6495	19.2515	19.6299	20.0278	20.2596	20.3687	20.3906	20.3896	20.3242	20.0116	19.4422	19.1226 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6495	19.2515	19.6299	20.0278	20.2596	20.3687	20.3906	20.3896	20.3242	20.0116	19.4422	19.1226 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	847.0758	920.2556	953.2646	906.7186	761.7192	531.1315	355.1763	371.0103	558.8272	731.9460	781.4283	806.5840 (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	1521.1160	1417.1640	1291.9099	1075.3240	824.1359	545.2672	358.2947	375.6968	592.7032	906.1689	1197.0251	1457.7978 (97)
Space heating kWh	501.4859	333.9224	251.9521	121.3959	46.4380	0.0000	0.0000	0.0000	0.0000	129.6219	299.2297	484.5031 (98a)
Space heating requirement - total per year (kWh/year)	2168.5491											
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	501.4859	333.9224	251.9521	121.3959	46.4380	0.0000	0.0000	0.0000	0.0000	129.6219	299.2297	484.5031 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2168.5491											
Space heating per m2	(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 %)	249.2796 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
501.4859	333.9224	251.9521	121.3959	46.4380	0.0000	0.0000	0.0000	0.0000	0.0000	129.6219	299.2297	484.5031 (98)
Space heating efficiency (main heating system 1)	249.2796	249.2796	249.2796	249.2796	249.2796	0.0000	0.0000	0.0000	0.0000	249.2796	249.2796	249.2796 (210)

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Space heating fuel (main heating system)	201.1741	133.9550	101.0721	48.6987	18.6289	0.0000	0.0000	0.0000	0.0000	51.9986	120.0378	194.3613	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844	(64)
Efficiency of water heater	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	(216)
Fuel for water heating, kWh/month	166.2286	146.9121	155.7644	136.1301	131.4206	117.8274	115.8185	120.7235	122.3944	137.1993	146.7786	164.2984	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
Pumps and Fa	37.7174	34.0674	37.7174	36.5007	37.7174	36.5007	37.7174	36.5007	37.7174	36.5007	37.7174	36.5007	(221)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												869.9263	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												169.5600	
Water heating fuel used												1661.4958	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)													
mechanical ventilation fans (SFP = 1.0875)												444.0924	(230a)
Total electricity for the above, kWh/year												444.0924	(231)
Electricity for lighting (calculated in Appendix L)												248.7750	(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	(235b)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3224.2896	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	869.9263	16.4900	143.4508 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1661.4958	16.4900	273.9807 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	444.0924	16.4900	73.2308 (249)
Energy for lighting	248.7750	16.4900	41.0230 (250)
Additional standing charges			0.0000 (251)
Total energy cost			531.6853 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0988 (257)
SAP value		82.1878
SAP rating (Section 12)		82 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	869.9263	0.1563	135.9895 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1661.4958	0.1410	234.2989 (264)
Space and water heating			370.2884 (265)
Pumps, fans and electric keep-hot	444.0924	0.1387	61.6011 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Total CO2, kg/year			467.7954 (272)
CO2 emissions per m2			3.6200 (273)
EI value			96.4014
EI rating			96 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	334.7220 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 = 0.0000 (6a)											
Number of open flues	0 * 20 = 0.0000 (6b)											
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)											
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)											
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)											
Number of blocked chimneys	0 * 20 = 0.0000 (6f)											
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)											
Number of passive vents	0 * 10 = 0.0000 (7b)											
Number of flueless gas fires	0 * 40 = 0.0000 (7c)											
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)											
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	3.0000 (17)											
Infiltration rate	0.1500 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)											
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000 (22)
Adj infilt rate	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750 (22a)
Balanced mechanical ventilation with heat recovery	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498 (22b)
If mechanical ventilation	0.5000 (23a)											
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)											
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	71.1000 (23c)											
Effective ac	0.3102	0.3102	0.3039	0.2847	0.2816	0.2688	0.2624	0.2624	0.2752	0.2911	0.2975	0.2943 (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						
Main dwelling													
Windows / Glazed Doors			25.5700	1.1450	29.2786			(27)					
Door			2.9300	1.2000	3.5160			(26)					
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000	(28a)					
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000	(28b)					
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200	(29a)					
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000	(29a)					
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400	(29a)					
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200	(30)					
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600	(30)					
Total net area of external elements Aum(A, m2)			182.0300					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.4391			(33)					
Main dwelling													
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000	(32)					
GF - Internal Wall 1			84.5100			9.0000	760.5900	(32c)					
FF - Internal Wall 2			94.5800			9.0000	851.2200	(32c)					
SF Internal Wall 3			54.9300			9.0000	494.3700	(32c)					
Internal Floor 1			46.9700			18.0000	845.4600	(32d)					
Internal Floor 2			32.8800			18.0000	591.8400	(32d)					
Internal Ceiling 1			46.9700			9.0000	422.7300	(32e)					
Internal Ceiling 2			32.8800			9.0000	295.9200	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12042.6700	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.2167	(35)					
Thermal bridges (User defined value 0.070 * total exposed area)							12.7421	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss					(33) + (36) + (36a) =		65.1812	(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	34.2697	34.2697	33.5655	31.4530	31.1009	29.6926	28.9884	28.9884	30.3967	32.1572	32.8613	32.5092	(38)
Average = Sum(39)m / 12 =	99.4509	99.4509	98.7467	96.6342	96.2821	94.8738	94.1696	94.1696	95.5780	97.3384	98.0426	97.6905	(39)
	96.8689												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.7698	0.7698	0.7644	0.7480	0.7453	0.7344	0.7289	0.7289	0.7398	0.7535	0.7589	0.7562	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8929 (42)											
Hot water usage for mixer showers	72.4449 (42a)											
Hot water usage for baths	31.2906 (42b)											
Hot water usage for other uses	44.2558 (42c)											
Average daily hot water use (litres/day)	136.3909 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.3761	145.2076	141.3491	135.4820	130.7175	125.5953	123.6269	127.4688	131.5206	136.8980	142.8555	147.9913 (44)
Energy content (annual)	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 2265.4253											
Water storage loss (or HIU loss):	35.2487 31.0161 32.5872 27.8202 26.3956 23.1651 22.4274 23.6749 24.3267 27.8654 30.5286 34.7578 (46)											
Store volume	250.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.4100 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	0.7614 (55)											
Total storage loss	23.6034 21.3192 23.6034 22.8420 23.6034 22.8420 23.6034 23.6034 22.8420 23.6034 22.8420 23.6034 (56)											
If cylinder contains dedicated solar storage	23.6034 21.3192 23.6034 22.8420 23.6034 22.8420 23.6034 23.6034 22.8420 23.6034 22.8420 23.6034 (57)											
Primary loss	23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)											
Combi loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)											
Total heat required for water heating calculated for each month	281.8573 249.1041 264.1141 230.8221 222.8367 199.7881 196.3819 204.6988 207.5320 232.6351 248.8778 278.5844 (62)											
WWHRS	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)											
PV diverter	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63b)											
Solar input	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)											
FGHRS	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)											
Output from w/h	281.8573 249.1041 264.1141 230.8221 222.8367 199.7881 196.3819 204.6988 207.5320 232.6351 248.8778 278.5844 (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	115.6273 102.6166 109.7277 97.9514 96.0030 87.6325 87.2067 89.9721 90.2074 99.2609 103.9549 114.5391 (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	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.2167	31.2791	25.4379	19.2581	14.3957	12.1534	13.1322	17.0698	22.9110	29.0908	33.9532	36.1955 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.8980	447.4939	435.9124	411.2567	380.1334	350.8818	331.3400	326.7441	338.3256	362.9812	394.1046	423.3561 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500 (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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144 (71)
Water heating gains (Table 5)	155.4130	152.7032	147.4835	136.0435	129.0362	121.7118	117.2133	120.9302	125.2880	133.4152	144.3817	153.9504 (72)
Total internal gains	746.6349	744.5835	721.9410	679.6656	636.6725	597.8543	574.7928	577.8513	599.6318	638.5944	685.5468	726.6092 (73)

6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Southeast	13.4600		33.4622		0.6000		0.7000		0.7700		131.0939 (77)	
Northwest	12.1100		10.0309		0.6000		0.7000		0.7700		35.3564 (81)	
Solar gains	166.4502	314.8761	484.6726	693.4663	825.8407	821.5581	791.4583	666.1800	539.5600	354.7044	207.0361	144.2956 (83)
Total gains	913.0851	1059.4595	1206.6136	1373.1319	1462.5132	1419.4124	1366.2511	1244.0313	1139.1918	993.2988	892.5828	870.9048 (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	33.6366	33.6366	33.8764	34.6170	34.7436	35.2593	35.5230	35.5230	34.9996	34.3666	34.1197	34.2427
alpha	3.2424	3.2424	3.2584	3.3078	3.3162	3.3506	3.3682	3.3682	3.3333	3.2911	3.2746	3.2828
util living area	0.9336	0.9010	0.8449	0.7357	0.6041	0.4915	0.4070	0.4491	0.6111	0.8044	0.9046	0.9416 (86)
Living	19.3821	19.6528	20.0417	20.5078	20.7913	20.9178	20.9643	20.9512	20.8307	20.4221	19.8418	19.3309
Non living	18.7858	19.0487	19.4269	19.8770	20.1349	20.2516	20.2926	20.2837	20.1788	19.8035	19.2450	18.7445
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1723	19.6528	20.0417	20.5078	20.7913	20.9178	20.9643	20.9512	20.8307	20.4221	19.8418	19.5643 (87)
Th 2	20.2796	20.2796	20.2843	20.2986	20.3010	20.3106	20.3154	20.3154	20.3058	20.2939	20.2891	20.2915 (88)
util rest of house	0.9264	0.8910	0.8301	0.7131	0.5731	0.4538	0.3647	0.4044	0.5720	0.7811	0.8932	0.9353 (89)
MIT 2	19.5154	19.0487	19.4269	19.8770	20.1349	20.2516	20.2926	20.2837	20.1788	19.8035	19.2450	18.9609 (90)
Living area fraction	19.5956	19.1224	19.5019	19.9540	20.2150	20.3329	20.3746	20.3652	20.2584	19.8790	19.3179	0.1221 (91)
MIT	19.5956	19.1224	19.5019	19.9540	20.2150	20.3329	20.3746	20.3652	20.2584	19.8790	19.3179	19.0346 (92)
Temperature adjustment	19.5956	19.1224	19.5019	19.9540	20.2150	20.3329	20.3746	20.3652	20.2584	19.8790	19.3179	0.0000
adjusted MIT	19.5956	19.1224	19.5019	19.9540	20.2150	20.3329	20.3746	20.3652	20.2584	19.8790	19.3179	19.0346 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9187	0.8721	0.8119	0.7012	0.5692	0.4550	0.3684	0.4077	0.5693	0.7660	0.8750	0.9218	(94)
Useful gains	838.8457	923.9654	979.6854	962.8660	832.4590	645.9002	503.3210	507.1890	648.5055	760.8616	780.9689	802.7793	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W	1560.9431	1474.1051	1372.7686	1164.8307	916.1270	676.7240	515.5406	524.0686	712.8592	990.8045	1246.8937	1498.0429	(97)
Space heating kWh	537.2405	369.6939	292.4540	145.4146	62.2490	0.0000	0.0000	0.0000	0.0000	171.0775	335.4659	517.2761	(98a)
Space heating requirement - total per year (kWh/year)												2430.8714	
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	537.2405	369.6939	292.4540	145.4146	62.2490	0.0000	0.0000	0.0000	0.0000	171.0775	335.4659	517.2761	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2430.8714	
Space heating per m2											(98c) / (4) =	18.8163	(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 %)													249.1877	(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	537.2405	369.6939	292.4540	145.4146	62.2490	0.0000	0.0000	0.0000	0.0000	171.0775	335.4659	517.2761	(98)	
Space heating efficiency (main heating system 1)	249.1877	249.1877	249.1877	249.1877	249.1877	0.0000	0.0000	0.0000	0.0000	249.1877	249.1877	249.1877	(210)	
Space heating fuel (main heating system)	215.5967	148.3596	117.3629	58.3555	24.9808	0.0000	0.0000	0.0000	0.0000	68.6541	134.6238	207.5849	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844	(64)	
Efficiency of water heater													169.5600	(216)
(217)m	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	(217)	
Fuel for water heating, kWh/month	166.2286	146.9121	155.7644	136.1301	131.4206	117.8274	115.8185	120.7235	122.3944	137.1993	146.7786	164.2984	(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	37.7174	34.0674	37.7174	36.5007	37.7174	36.5007	37.7174	37.7174	36.5007	37.7174	36.5007	37.7174	(231)	
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817	(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													975.5182	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													169.5600	
Water heating fuel used													1661.4958	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)														
mechanical ventilation fans (SFP = 1.0875)													444.0924	(230a)
Total electricity for the above, kWh/year													444.0924	(231)
Electricity for lighting (calculated in Appendix L)													248.7750	(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													3329.8815	(238)

10a. Fuel costs - using BEDF prices (585)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	975.5182	28.4300	277.3398	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1661.4958	28.4300	472.3633	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	444.0924	28.4300	126.2555	(249)
Energy for lighting	248.7750	28.4300	70.7267	(250)

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Additional standing charges
Total energy cost

0.0000 (251)
946.6853 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	975.5182	0.1558	151.9801 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1661.4958	0.1410	234.2989 (264)
Space and water heating			386.2790 (265)
Pumps, fans and electric keep-hot	444.0924	0.1387	61.6011 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Total CO2, kg/year			483.7860 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	975.5182	1.5767	1538.1439 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1661.4958	1.5214	2527.8577 (278)
Space and water heating			4066.0016 (279)
Pumps, fans and electric keep-hot	444.0924	1.5128	671.8230 (281)
Energy for lighting	248.7750	1.5338	381.5794 (282)
Total Primary energy kWh/year			5119.4040 (286)

SAP 10 EPC IMPROVEMENTS

Type B

Current energy efficiency rating: B 82
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.8	-£ 93	-41 kg (8.4%)
U Solar photovoltaic panels	+ 6.6	-£ 312	-224 kg (50.6%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£93	0.31 kg/m²	B 84 A 97
Solar photovoltaic panels	£312	1.73 kg/m²	B 91 A 98
Total Savings	£404	2.05 kg/m²	

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

	Current £947	Potential £854	Saving £93
Electricity			
Space heating	£404	£427	-£23
Water heating	£472	£356	£116
Lighting	£71	£71	£0
Generated (PV)	-£0	-£312	£312
Total cost of fuels	£947	£542	£405
Total cost of uses	£947	£542	£405
Delivered energy	26 kWh/m²	10 kWh/m²	16 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.2 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	2 kg/m²	2 kg/m²
Primary energy	40 kWh/m²	22 kWh/m²	17 kWh/m²

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

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 334.7220 (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												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												3.0000 (17)	
Infiltration rate												0.1500 (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) =	0.1275 (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)	
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													
	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)	
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												71.1000 (23c)	
Effective ac	0.3071	0.3039	0.3007	0.2847	0.2816	0.2656	0.2656	0.2624	0.2720	0.2816	0.2879	0.2943 (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					
Main dwelling												
Windows / Glazed Doors			25.5700	1.1450	29.2786			(27)				
Door			2.9300	1.2000	3.5160			(26)				
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000	(28a)				
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000	(28b)				
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200	(29a)				
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000	(29a)				
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400	(29a)				
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200	(30)				
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600	(30)				
Total net area of external elements Aum(A, m2)			182.0300					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	52.4391			(33)				
Main dwelling												
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000	(32)				
GF - Internal Wall 1			84.5100			9.0000	760.5900	(32c)				
FF - Internal Wall 2			94.5800			9.0000	851.2200	(32c)				
SF Internal Wall 3			54.9300			9.0000	494.3700	(32c)				
Internal Floor 1			46.9700			18.0000	845.4600	(32d)				
Internal Floor 2			32.8800			18.0000	591.8400	(32d)				
Internal Ceiling 1			46.9700			9.0000	422.7300	(32e)				
Internal Ceiling 2			32.8800			9.0000	295.9200	(32e)				
Heat capacity Cm = Sum(A x k)					(28)... (30) + (32) + (32a)... (32e) =		12042.6700	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.2167	(35)				
Thermal bridges (User defined value 0.070 * total exposed area)							12.7421	(36)				
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss					(33) + (36) + (36a) =		65.1812	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.9176	Feb 33.5655	Mar 33.2134	Apr 31.4530	May 31.1009	Jun 29.3405	Jul 29.3405	Aug 28.9884	Sep 30.0446	Oct 31.1009	Nov 31.8051	Dec 32.5092 (38)
Heat transfer coeff	99.0988	98.7467	98.3946	96.6342	96.2821	94.5217	94.5217	94.1696	95.2259	96.2821	96.9863	97.6905 (39)
Average = Sum(39)m / 12 =												96.5462
HLP	Jan 0.7671	Feb 0.7644	Mar 0.7616	Apr 0.7480	May 0.7453	Jun 0.7316	Jul 0.7316	Aug 0.7289	Sep 0.7371	Oct 0.7453	Nov 0.7507	Dec 0.7562 (40)
HLP (average)												0.7473
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8929 (42)	
Hot water usage for mixer showers	72.7236	71.6307	70.0381	66.9910	64.7424	62.2347	60.8093	62.3898	64.1224	66.8149	69.9274	72.4449 (42a)	
Hot water usage for baths	31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906 (42b)	
Hot water usage for other uses	44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558 (42c)	
Average daily hot water use (litres/day)												136.3909 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	148.3761	145.2076	141.3491	135.4820	130.7175	125.5953	123.6269	127.4688	131.5206	136.8980	142.8555	147.9913 (44)	
Energy content (annual)	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186 (45)	
Distribution loss (46)m = 0.15 x (45)m	35.2487	31.0161	32.5872	27.8202	26.3956	23.1651	22.4274	23.6749	24.3267	27.8654	30.5286	34.7578 (46)	
Water storage loss (or HIU loss):												Total = Sum(45)m =	2265.4253

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Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034 (56)
If cylinder contains dedicated solar storage	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	281.8573	249.1041	262.7184	224.0685	210.0424	187.1813	183.3549	192.6023	202.1291	231.2393	248.8778	278.5844 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												626.1235 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												626.1235
Solar input	-0.0000	-16.2003	-58.6116	-80.7358	-105.6266	-97.2978	-96.5324	-84.3402	-58.0703	-28.7085	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	281.8573	232.9038	204.1068	143.3328	104.4158	89.8835	86.8225	108.2621	144.0589	202.5309	248.8778	278.5844 (64)
											Total per year (kWh/year) = Sum(64)m =	2125.6365 (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	115.6273	102.6166	108.6111	92.5485	85.7675	77.5471	76.7852	80.2949	85.8851	98.1443	103.9549	114.5391 (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	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.2167	31.2791	25.4379	19.2581	14.3957	12.1534	13.1322	17.0698	22.9110	29.0908	33.9532	36.1955 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.8980	447.4939	435.9124	411.2567	380.1334	350.8818	331.3400	326.7441	338.3256	362.9812	394.1046	423.3561 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500 (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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144 (71)
Water heating gains (Table 5)	155.4130	152.7032	145.9827	128.5395	115.2789	107.7044	103.2059	107.9233	119.2848	131.9144	144.3817	153.9504 (72)
Total internal gains	746.6349	744.5835	720.4402	672.1616	622.9152	583.8468	560.7853	564.8444	593.6286	637.0936	685.5468	726.6092 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast												13.4600	36.7938	0.6000	0.7000	0.7700	144.1460 (77)
Northwest												12.1100	11.2829	0.6000	0.7000	0.7700	39.7694 (81)
Solar gains	183.9154	326.4857	481.7996	655.7852	788.2150	806.1275	767.3665	664.9580	541.4828	370.2968	222.6939	155.8366 (83)					
Total gains	930.5503	1071.0692	1202.2398	1327.9468	1411.1302	1389.9744	1328.1518	1229.8024	1135.1114	1007.3905	908.2406	882.4458 (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	33.7561	33.8764	33.9976	34.6170	34.7436	35.3907	35.3907	35.5230	35.1290	34.7436	34.4913	34.2427
alpha	3.2504	3.2584	3.2665	3.3078	3.3162	3.3594	3.3594	3.3682	3.3419	3.3162	3.2994	3.2828
util living area	0.9263	0.8893	0.8265	0.7169	0.5749	0.4198	0.3088	0.3454	0.5356	0.7660	0.8915	0.9352 (86)
Living	19.4855	19.7815	20.1709	20.5816	20.8376	20.9584	20.9887	20.9836	20.9051	20.5573	19.9646	19.4345
Non living	18.8891	19.1778	19.5531	19.9464	20.1759	20.2858	20.3072	20.3066	20.2424	19.9346	19.3696	18.8467
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2252	19.7815	20.1709	20.5816	20.8376	20.9584	20.9887	20.9836	20.9051	20.5573	19.9646	19.6535 (87)
Th 2	20.2820	20.2843	20.2867	20.2986	20.3010	20.3130	20.3130	20.3154	20.3082	20.3010	20.2962	20.2915 (88)
util rest of house	0.9182	0.8780	0.8096	0.6917	0.5408	0.3784	0.2620	0.2962	0.4908	0.7385	0.8786	0.9280 (89)
MIT 2	19.5694	19.1778	19.5531	19.9464	20.1759	20.2858	20.3072	20.3066	20.2424	19.9346	19.3696	19.0488 (90)
Living area fraction												0.1221 (91)
MIT	19.6495	19.2515	19.6285	20.0239	20.2566	20.3679	20.3904	20.3893	20.3233	20.0106	19.4422	19.1226 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6495	19.2515	19.6285	20.0239	20.2566	20.3679	20.3904	20.3893	20.3233	20.0106	19.4422	19.1226 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9103	0.8592	0.7923	0.6812	0.5386	0.3818	0.2673	0.3015	0.4918	0.7261	0.8604	0.9140	(94)
Useful gains	847.0758	920.2556	952.5726	904.6454	760.0473	530.6624	355.0582	370.8360	558.3035	731.4316	781.4283	806.5840	(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	1521.1160	1417.1640	1291.7772	1074.9500	823.8523	545.1919	358.2759	375.6690	592.6163	906.0745	1197.0251	1457.7978	(97)
Space heating kWh	501.4859	333.9224	252.3683	122.6193	47.4709	0.0000	0.0000	0.0000	0.0000	129.9343	299.2297	484.5031	(98a)
Space heating requirement - total per year (kWh/year)												2171.5340	
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	501.4859	333.9224	252.3683	122.6193	47.4709	0.0000	0.0000	0.0000	0.0000	129.9343	299.2297	484.5031	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2171.5340	
Space heating per m2										(98c) / (4) =		16.8088	(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 %)	249.2796	(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	501.4859	333.9224	252.3683	122.6193	47.4709	0.0000	0.0000	0.0000	0.0000	129.9343	299.2297	484.5031	(98)
Space heating efficiency (main heating system 1)	249.2796	249.2796	249.2796	249.2796	249.2796	0.0000	0.0000	0.0000	0.0000	249.2796	249.2796	249.2796	(210)
Space heating fuel (main heating system)	201.1741	133.9550	101.2390	49.1895	19.0432	0.0000	0.0000	0.0000	0.0000	52.1239	120.0378	194.3613	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	281.8573	232.9038	204.1068	143.3328	104.4158	89.8835	86.8225	108.2621	144.0589	202.5309	248.8778	278.5844	(64)
Efficiency of water heater (217)m	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	(216)
Fuel for water heating, kWh/month	166.2286	137.3578	120.3744	84.5322	61.5805	53.0099	51.2046	63.8488	84.9604	119.4450	146.7786	164.2984	(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	44.5120	40.2044	44.5120	43.0761	44.5120	43.0761	44.5120	44.5120	43.0761	44.5120	43.0761	44.5120	(231)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-38.9773	-58.3668	-88.0968	-102.2953	-111.6229	-104.0142	-102.6729	-95.8306	-83.4468	-67.9199	-43.8019	-33.2240	(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	-11.1092	-25.2132	-54.2495	-88.4767	-124.0599	-127.6995	-125.9787	-103.9434	-73.0163	-38.9260	-15.6079	-8.6898	(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												871.1237	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												169.5600	
Water heating fuel used												1253.6190	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)		
mechanical ventilation fans (SFP = 1.0875)		444.0924 (230a)
pump for solar water heating		80.0000 (230g)
Total electricity for the above, kWh/year		524.0924 (231)
Electricity for lighting (calculated in Appendix L)		248.7750 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-1727.2394 (233)
Wind generation		0.0000 (234)
Hydro-electric generation (Appendix N)		0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)		0.0000 (235)
Appendix Q - special features		
Energy saved or generated		-0.0000 (236)
Energy used		0.0000 (237)
Total delivered energy for all uses		1170.3708 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	871.1237	16.4900	143.6483 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1253.6190	16.4900	206.7218 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	444.0924	16.4900	73.2308 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	248.7750	16.4900	41.0230 (250)
Additional standing charges			0.0000 (251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-930.2693	16.4900	-153.4014
PV Unit electricity exported	-796.9701	5.5900	-44.5506
Total			-197.9520 (252)
Total energy cost			279.8639 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.5784 (257)
SAP value		90.6242
SAP rating (Section 12)		91 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	871.1237	0.1563	136.1570 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1253.6190	0.1455	182.4564 (264)
Space and water heating			318.6133 (265)
Pumps, fans and electric keep-hot	524.0924	0.1387	72.6981 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-930.2693	0.1339	-124.5919
PV Unit electricity exported	-796.9701	0.1237	-98.5484
Total			-223.1402 (269)
Total CO2, kg/year			204.0771 (272)
CO2 emissions per m2			1.5800 (273)
EI value			98.4301
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	334.7220 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (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) = 0.1275 (21)
Wind speed	Jan 5.2000 Feb 5.2000 Mar 5.0000 Apr 4.4000 May 4.3000 Jun 3.9000 Jul 3.7000 Aug 3.7000 Sep 4.1000 Oct 4.6000 Nov 4.8000 Dec 4.7000 (22)
Wind factor	1.3000 1.3000 1.2500 1.1000 1.0750 0.9750 0.9250 0.9250 1.0250 1.1500 1.2000 1.1750 (22a)
Adj infilt rate	0.1658 0.1658 0.1594 0.1403 0.1371 0.1243 0.1179 0.1179 0.1307 0.1466 0.1530 0.1498 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	71.1000 (23c)
Effective ac	0.3102 0.3102 0.3039 0.2847 0.2816 0.2688 0.2624 0.2624 0.2752 0.2911 0.2975 0.2943 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
Windows / Glazed Doors			25.5700	1.1450	29.2786			(27)					
Door			2.9300	1.2000	3.5160			(26)					
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000	(28a)					
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000	(28b)					
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200	(29a)					
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000	(29a)					
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400	(29a)					
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200	(30)					
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600	(30)					
Total net area of external elements Aum(A, m2)			182.0300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.4391			(33)					
Main dwelling													
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000	(32)					
GF - Internal Wall 1			84.5100			9.0000	760.5900	(32c)					
FF - Internal Wall 2			94.5800			9.0000	851.2200	(32c)					
SF Internal Wall 3			54.9300			9.0000	494.3700	(32c)					
Internal Floor 1			46.9700			18.0000	845.4600	(32d)					
Internal Floor 2			32.8800			18.0000	591.8400	(32d)					
Internal Ceiling 1			46.9700			9.0000	422.7300	(32e)					
Internal Ceiling 2			32.8800			9.0000	295.9200	(32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	12042.6700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								93.2167 (35)					
Thermal bridges (User defined value 0.070 * total exposed area)								12.7421 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	65.1812 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.2697	Feb 34.2697	Mar 33.5655	Apr 31.4530	May 31.1009	Jun 29.6926	Jul 28.9884	Aug 28.9884	Sep 30.3967	Oct 32.1572	Nov 32.8613	Dec 32.5092	(38)
Heat transfer coeff	99.4509	99.4509	98.7467	96.6342	96.2821	94.8738	94.1696	94.1696	95.5780	97.3384	98.0426	97.6905	(39)
Average = Sum(39)m / 12 =												96.8689	
HLP	Jan 0.7698	Feb 0.7698	Mar 0.7644	Apr 0.7480	May 0.7453	Jun 0.7344	Jul 0.7289	Aug 0.7289	Sep 0.7398	Oct 0.7535	Nov 0.7589	Dec 0.7562	(40)
HLP (average)												0.7498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8929 (42)
Hot water usage for mixer showers													
Hot water usage for baths	72.7236	71.6307	70.0381	66.9910	64.7424	62.2347	60.8093	62.3898	64.1224	66.8149	69.9274	72.4449	(42a)
Hot water usage for other uses	31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906	(42b)
Average daily hot water use (litres/day)	44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558	(42c)
												136.3909	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	148.3761	145.2076	141.3491	135.4820	130.7175	125.5953	123.6269	127.4688	131.5206	136.8980	142.8555	147.9913	(44)
Energy content (annual)	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186	(45)
Distribution loss (46)m = 0.15 x (45)m	35.2487	31.0161	32.5872	27.8202	26.3956	23.1651	22.4274	23.6749	24.3267	27.8654	30.5286	34.7578	(46)
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	(56)
If cylinder contains dedicated solar storage	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	281.8573	249.1041	262.7184	224.0685	210.0424	187.1813	183.3549	192.6023	202.1291	231.2393	248.8778	278.5844	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													626.1042 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													626.1042
Solar input	-0.0000	-13.2279	-57.6950	-85.6679	-110.2962	-98.0444	-98.2385	-82.7168	-56.0520	-24.1656	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	281.8573	235.8762	205.0234	138.4007	99.7461	89.1370	85.1164	109.8855	146.0772	207.0738	248.8778	278.5844	(64)
												2125.6557	(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	115.6273	102.6166	108.6111	92.5485	85.7675	77.5471	76.7852	80.2949	85.8851	98.1443	103.9549	114.5391	(65)

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

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Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.2167	31.2791	25.4379	19.2581	14.3957	12.1534	13.1322	17.0698	22.9110	29.0908	33.9532	36.1955 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.8980	447.4939	435.9124	411.2567	380.1334	350.8818	331.3400	326.7441	338.3256	362.9812	394.1046	423.3561 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500 (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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144 (71)
Water heating gains (Table 5)	155.4130	152.7032	145.9827	128.5395	115.2789	107.7044	103.2059	107.9233	119.2848	131.9144	144.3817	153.9504 (72)
Total internal gains	746.6349	744.5835	720.4402	672.1616	622.9152	583.8468	560.7853	564.8444	593.6286	637.0936	685.5468	726.6092 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast	13.4600		33.4622		0.6000		0.7000		0.7700		131.0939 (77)	
Northwest	12.1100		10.0309		0.6000		0.7000		0.7700		35.3564 (81)	
Solar gains	166.4502	314.8761	484.6726	693.4663	825.8407	821.5581	791.4583	666.1800	539.5600	354.7044	207.0361	144.2956 (83)
Total gains	913.0851	1059.4595	1205.1128	1365.6279	1448.7558	1405.4050	1352.2436	1231.0243	1133.1886	991.7980	892.5828	870.9048 (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	33.6366	33.6366	33.8764	34.6170	34.7436	35.2593	35.5230	35.5230	34.9996	34.3666	34.1197	34.2427
alpha	3.2424	3.2424	3.2584	3.3078	3.3162	3.3506	3.3682	3.3682	3.3333	3.2911	3.2746	3.2828
util living area	0.9336	0.9010	0.8453	0.7380	0.6082	0.4956	0.4108	0.4533	0.6134	0.8050	0.9046	0.9416 (86)
Living	19.3821	19.6528	20.0401	20.5030	20.7869	20.9157	20.9633	20.9498	20.8287	20.4208	19.8418	19.3309
Non living	18.7858	19.0487	19.4254	19.8727	20.1313	20.2500	20.2919	20.2828	20.1773	19.8023	19.2450	18.7445
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1723	19.6528	20.0401	20.5030	20.7869	20.9157	20.9633	20.9498	20.8287	20.4208	19.8418	19.5643 (87)
Th 2	20.2796	20.2796	20.2843	20.2986	20.3010	20.3106	20.3154	20.3154	20.3058	20.2939	20.2891	20.2915 (88)
util rest of house	0.9264	0.8910	0.8305	0.7154	0.5773	0.4578	0.3682	0.4083	0.5744	0.7817	0.8932	0.9353 (89)
MIT 2	19.5154	19.0487	19.4254	19.8727	20.1313	20.2500	20.2919	20.2828	20.1773	19.8023	19.2450	18.9609 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.5956	19.1224	19.5004	19.9497	20.2113	20.3313	20.3739	20.3642	20.2568	19.8778	19.3179	19.0346 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5956	19.1224	19.5004	19.9497	20.2113	20.3313	20.3739	20.3642	20.2568	19.8778	19.3179	19.0346 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9187	0.8721	0.8123	0.7034	0.5732	0.4589	0.3719	0.4115	0.5715	0.7665	0.8750	0.9218 (94)
Useful gains	838.8457	923.9654	978.9343	960.5568	830.3765	644.9627	502.8994	506.6150	647.6074	760.2431	780.9689	802.7793 (95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000 (96)
Heat loss rate W	1560.9431	1474.1051	1372.6231	1164.4101	915.7691	676.5705	515.4732	523.9761	712.7056	990.6880	1246.8937	1498.0429 (97)
Space heating kWh	537.2405	369.6939	292.9045	146.7743	63.5321	0.0000	0.0000	0.0000	0.0000	171.4510	335.4659	517.2761 (98a)
Space heating requirement - total per year (kWh/year)												2434.3384
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	537.2405	369.6939	292.9045	146.7743	63.5321	0.0000	0.0000	0.0000	0.0000	171.4510	335.4659	517.2761 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2434.3384
Space heating per m ²										(98c) / (4) =		18.8431 (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 %)												249.1877 (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	537.2405	369.6939	292.9045	146.7743	63.5321	0.0000	0.0000	0.0000	0.0000	171.4510	335.4659	517.2761 (98)
Space heating efficiency (main heating system 1)	249.1877	249.1877	249.1877	249.1877	249.1877	0.0000	0.0000	0.0000	0.0000	249.1877	249.1877	249.1877 (210)
Space heating fuel (main heating system)	215.5967	148.3596	117.5437	58.9011	25.4957	0.0000	0.0000	0.0000	0.0000	68.8040	134.6238	207.5849 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												

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Water heating requirement	281.8573	235.8762	205.0234	138.4007	99.7461	89.1370	85.1164	109.8855	146.0772	207.0738	248.8778	278.5844 (64)
Efficiency of water heater												169.5600 (216)
(217)m	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600 (217)
Fuel for water heating, kWh/month	166.2286	139.1108	120.9150	81.6234	58.8265	52.5696	50.1984	64.8063	86.1507	122.1242	146.7786	164.2984 (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	44.5120	40.2044	44.5120	43.0761	44.5120	43.0761	44.5120	44.5120	43.0761	44.5120	43.0761	44.5120 (231)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-35.6104	-56.6689	-88.8515	-106.6737	-115.3344	-105.2471	-104.5397	-96.0574	-83.2075	-66.0008	-41.1142	-30.9345 (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	-9.4516	-23.5219	-53.8929	-94.9820	-131.9337	-131.3473	-131.6866	-104.1750	-72.3822	-35.8811	-13.8002	-7.6417 (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												976.9095 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.5600
Water heating fuel used												1253.6304 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)												
mechanical ventilation fans (SFP = 1.0875)												444.0924 (230a)
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												524.0924 (231)
Electricity for lighting (calculated in Appendix L)												248.7750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1740.9362 (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												1262.4712 (238)

10a. Fuel costs - using BEDF prices (585)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	976.9095	28.4300	277.7354 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1253.6304	28.4300	356.4071 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	444.0924	28.4300	126.2555 (249)
Pump for solar water heating	80.0000	28.4300	22.7440 (249)
Energy for lighting	248.7750	28.4300	70.7267 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-930.2400	28.4300	-264.4672
PV Unit electricity exported	-810.6962	5.8100	-47.1015
Total			-311.5687 (252)
Total energy cost			542.3000 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	976.9095	0.1558	152.1742 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1253.6304	0.1456	182.4924 (264)
Space and water heating			334.6665 (265)
Pumps, fans and electric keep-hot	524.0924	0.1387	72.6981 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-930.2400	0.1336	-124.3142
PV Unit electricity exported	-810.6962	0.1231	-99.7822
Total			-224.0964 (269)
Total CO2, kg/year			219.1741 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	976.9095	1.5767	1540.2534 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1253.6304	1.5385	1928.6818 (278)
Space and water heating			3468.9352 (279)
Pumps, fans and electric keep-hot	524.0924	1.5128	792.8470 (281)
Energy for lighting	248.7750	1.5338	381.5794 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-930.2400	1.4939	-1389.6523
PV Unit electricity exported	-810.6962	0.4517	-366.1922
Total			-1755.8446 (283)

Total Primary energy kWh/year

2887.5171 (286)

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Plot Reference	Lean, Clean & Green - Plot 25			Issued on Date	03/12/2025
Assessment Reference	Type B	Plot Type Ref			
Plot Address	P01			SAP Version	10.2
SAP Rating	92 A	DER	1.14	TER	9.50
Environmental	99 A	% DER < TER			88.00
CO ₂ Emissions (t/year)	0.15	DFEE	31.62	TFEE	34.44
Compliance Check	See BREL	% DFEE < TFEE			8.20
% DPER < TPER	59.29	DPER	20.14	TPER	49.47
Assessor Details	Mr. Robert Buchanan			Assessor ID	DU20-0001
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)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 334.7220 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys	0 * 80 = 0.0000 (6a)											
Number of open flues	0 * 20 = 0.0000 (6b)											
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)											
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)											
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)											
Number of blocked chimneys	0 * 20 = 0.0000 (6f)											
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)											
Number of passive vents	0 * 10 = 0.0000 (7b)											
Number of flueless gas fires	0 * 40 = 0.0000 (7c)											
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)											
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	3.0000 (17)											
Infiltration rate	0.1500 (18)											
Number of sides sheltered	2 (19)											
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)											
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (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)
Balanced mechanical ventilation with heat recovery	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
If mechanical ventilation	0.5000 (23a)											
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)											
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	71.1000 (23c)											
Effective ac	0.3071	0.3039	0.3007	0.2847	0.2816	0.2656	0.2656	0.2624	0.2720	0.2816	0.2879	0.2943 (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
Main dwelling							
Windows / Glazed Doors			25.5700	1.1450	29.2786		(27)
Door			2.9300	1.2000	3.5160		(26)
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000 (28a)
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000 (28b)
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200 (29a)
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000 (29a)
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400 (29a)
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200 (30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600 (30)
Total net area of external elements Aum(A, m ²)			182.0300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	52.4391	(33)
Main dwelling							
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000 (32)

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GF - Internal Wall 1	84.5100	9.0000	760.5900 (32c)
FF - Internal Wall 2	94.5800	9.0000	851.2200 (32c)
SF Internal Wall 3	54.9300	9.0000	494.3700 (32c)
Internal Floor 1	46.9700	18.0000	845.4600 (32d)
Internal Floor 2	32.8800	18.0000	591.8400 (32d)
Internal Ceiling 1	46.9700	9.0000	422.7300 (32e)
Internal Ceiling 2	32.8800	9.0000	295.9200 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
 Thermal bridges (User defined value 0.070 * total exposed area)
 Point Thermal bridges
 Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 12042.6700 (34)
 93.2167 (35)
 12.7421 (36)
 (36a) = 0.0000
 (33) + (36) + (36a) = 65.1812 (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
 33.9176 33.5655 33.2134 31.4530 31.1009 29.3405 29.3405 28.9884 30.0446 31.1009 31.8051 32.5092 (38)
 Heat transfer coeff
 99.0988 98.7467 98.3946 96.6342 96.2821 94.5217 94.5217 94.1696 95.2259 96.2821 96.9863 97.6905 (39)
 Average = Sum(39)m / 12 = 96.5462

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.7671 0.7644 0.7616 0.7480 0.7453 0.7316 0.7316 0.7289 0.7371 0.7453 0.7507 0.7562 (40)
 HLP (average) 0.7473
 Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8929 (42)
 Hot water usage for mixer showers 72.7236 71.6307 70.0381 66.9910 64.7424 62.2347 60.8093 62.3898 64.1224 66.8149 69.9274 72.4449 (42a)
 Hot water usage for baths 31.3967 30.9305 30.2738 29.0631 28.1566 27.1513 26.6084 27.2604 27.9703 29.0460 30.2816 31.2906 (42b)
 Hot water usage for other uses 44.2558 42.6465 41.0372 39.4279 37.8186 36.2093 36.2093 37.8186 39.4279 41.0372 42.6465 44.2558 (42c)
 Average daily hot water use (litres/day) 136.3909 (43)
 Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 148.3761 145.2076 141.3491 135.4820 130.7175 125.5953 123.6269 127.4688 131.5206 136.8980 142.8555 147.9913 (44)
 Energy conte 234.9915 206.7737 217.2483 185.4681 175.9709 154.4341 149.5161 157.8330 162.1780 185.7693 203.5238 231.7186 (45)
 Energy content (annual) Total = Sum(45)m = 2265.4253
 Distribution loss (46)m = 0.15 x (45)m 35.2487 31.0161 32.5872 27.8202 26.3956 23.1651 22.4274 23.6749 24.3267 27.8654 30.5286 34.7578 (46)
 Water storage loss (or HIU loss):
 Store volume 250.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 1.4100 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 0.7614 (55)
 23.6034 21.3192 23.6034 22.8420 23.6034 22.8420 23.6034 23.6034 22.8420 23.6034 22.8420 23.6034 (56)
 If cylinder contains dedicated solar storage 23.6034 21.3192 23.6034 22.8420 23.6034 22.8420 23.6034 23.6034 22.8420 23.6034 22.8420 23.6034 (57)
 Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
 Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
 Total heat required for water heating calculated for each month 281.8573 249.1041 264.1141 230.8221 222.8367 199.7881 196.3819 204.6988 207.5320 232.6351 248.8778 278.5844 (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)
 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 281.8573 249.1041 264.1141 230.8221 222.8367 199.7881 196.3819 204.6988 207.5320 232.6351 248.8778 278.5844 (64)
 Total per year (kWh/year) = Sum(64)m = 2817.2323 (64)
 2817 (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 115.6273 102.6166 109.7277 97.9514 96.0030 87.6325 87.2067 89.9721 90.2074 99.2609 103.9549 114.5391 (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
 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 144.6430 (66)
 Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 150.8956 167.0630 150.8956 155.9255 150.8956 155.9255 150.8956 150.8956 155.9255 150.8956 155.9255 150.8956 (67)
 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 296.7416 299.8209 292.0613 275.5420 254.6894 235.0908 221.9978 218.9185 226.6781 243.1974 264.0501 283.6486 (68)
 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 37.4643 (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) -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 -115.7144 (71)
 Water heating gains (Table 5) 155.4130 152.7032 147.4835 136.0435 129.0362 121.7118 117.2133 120.9302 125.2880 133.4152 144.3817 153.9504 (72)
 Total internal gains 669.4432 685.9800 656.8333 633.9039 601.0141 579.1210 556.4996 557.1373 574.2845 593.9012 630.7502 654.8875 (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
South-east	13.4600	36.7938	0.6000	0.7000	0.7700	144.1460 (77)
North-west	12.1100	11.2829	0.6000	0.7000	0.7700	39.7694 (81)
Solar gains	183.9154	326.4857	481.7996	655.7852	788.2150	806.1275
	767.3665	664.9580	541.4828	370.2968	222.6939	155.8366 (83)

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Total gains 853.3586 1012.4658 1138.6329 1289.6891 1389.2291 1385.2485 1323.8662 1222.0953 1115.7673 964.1980 853.4441 810.7241 (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	33.7561	33.8764	33.9976	34.6170	34.7436	35.3907	35.3907	35.5230	35.1290	34.7436	34.4913	34.2427
alpha	3.2504	3.2584	3.2665	3.3078	3.3162	3.3594	3.3594	3.3682	3.3419	3.3162	3.2994	3.2828
util living area	0.9402	0.9022	0.8436	0.7289	0.5817	0.4211	0.3097	0.3474	0.5430	0.7826	0.9056	0.9475 (86)
Living	19.3716	19.7068	20.1077	20.5588	20.8318	20.9580	20.9886	20.9833	20.9010	20.5244	19.8938	19.3250
Non living	18.7784	19.1063	19.4941	19.9262	20.1711	20.2855	20.3072	20.3065	20.2395	19.9056	19.3022	18.7399
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1670	19.7068	20.1077	20.5588	20.8318	20.9580	20.9886	20.9833	20.9010	20.5244	19.8938	19.5593 (87)
Th 2	20.2820	20.2843	20.2867	20.2986	20.3010	20.3130	20.3130	20.3154	20.3082	20.3010	20.2962	20.2915 (88)
util rest of house	0.9334	0.8919	0.8277	0.7041	0.5476	0.3796	0.2628	0.2980	0.4980	0.7560	0.8939	0.9415 (89)
MIT 2	19.5128	19.1063	19.4941	19.9262	20.1711	20.2855	20.3072	20.3065	20.2395	19.9056	19.3022	18.9570 (90)
Living area fraction									fLA = Living area / (4) =			0.1221 (91)
MIT	19.5927	19.1796	19.5690	20.0034	20.2518	20.3676	20.3903	20.3891	20.3202	19.9812	19.3744	19.0305 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5927	19.1796	19.5690	20.0034	20.2518	20.3676	20.3903	20.3891	20.3202	19.9812	19.3744	19.0305 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9260	0.8733	0.8099	0.6930	0.5451	0.3830	0.2682	0.3034	0.4988	0.7426	0.8759	0.9286 (94)
Useful gains	790.2096	884.1405	922.1474	893.7052	757.2923	530.5005	355.0212	370.7294	556.5590	716.0382	747.5458	752.8155 (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	1515.4857	1410.0627	1285.9223	1072.9704	823.3841	545.1659	358.2700	375.6521	592.3265	903.2386	1190.4488	1448.7984 (97)
Space heating kWh	539.6054	353.4197	270.6485	129.0710	49.1723	0.0000	0.0000	0.0000	0.0000	139.2771	318.8902	517.8113 (98a)
Space heating requirement - total per year (kWh/year)												2317.8955
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	539.6054	353.4197	270.6485	129.0710	49.1723	0.0000	0.0000	0.0000	0.0000	139.2771	318.8902	517.8113 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2317.8955
Space heating per m2										(98c) / (4) =		17.9418 (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 %)												249.2796 (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	539.6054	353.4197	270.6485	129.0710	49.1723	0.0000	0.0000	0.0000	0.0000	139.2771	318.8902	517.8113 (98)
Space heating efficiency (main heating system 1)	249.2796	249.2796	249.2796	249.2796	249.2796	0.0000	0.0000	0.0000	0.0000	249.2796	249.2796	249.2796 (210)
Space heating fuel (main heating system)	216.4659	141.7764	108.5722	51.7776	19.7258	0.0000	0.0000	0.0000	0.0000	55.8718	127.9247	207.7231 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844 (64)
Efficiency of water heater (217)m	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600 (216)
Fuel for water heating, kWh/month	166.2286	146.9121	155.7644	136.1301	131.4206	117.8274	115.8185	120.7235	122.3944	137.1993	146.7786	164.2984 (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	37.7174	34.0674	37.7174	36.5007	37.7174	36.5007	37.7174	37.7174	36.5007	37.7174	36.5007	37.7174 (231)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-48.4893	-73.3562	-114.4555	-137.5586	-154.4166	-144.8098	-142.2588	-129.9168	-108.5024	-85.6219	-54.3586	-41.1818 (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	-15.8971	-37.2615	-84.6635	-148.5268	-218.4600	-230.4589	-224.3336	-176.8585	-116.4606	-58.4753	-22.5859	-12.3415 (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												929.8375 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.5600
Water heating fuel used												1661.4958 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)	
mechanical ventilation fans (SFP = 1.0875)	444.0924 (230a)
Total electricity for the above, kWh/year	444.0924 (231)
Electricity for lighting (calculated in Appendix L)	248.7750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2581.2496 (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	702.9512 (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	929.8375	0.1563	145.3618 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1661.4958	0.1410	234.2989 (264)
Space and water heating			379.6606 (265)
Pumps, fans and electric keep-hot	444.0924	0.1387	61.6011 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1234.9264	0.1334	-164.7276
PV Unit electricity exported	-1346.3233	0.1222	-164.5613
Total			-329.2889 (269)
Total CO2, kg/year			147.8788 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.1400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	929.8375	1.5787	1467.9471 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1661.4958	1.5214	2527.8577 (278)
Space and water heating			3995.8049 (279)
Pumps, fans and electric keep-hot	444.0924	1.5128	671.8230 (281)
Energy for lighting	248.7750	1.5338	381.5794 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1234.9264	1.4929	-1843.6546
PV Unit electricity exported	-1346.3233	0.4485	-603.7839
Total			-2447.4385 (283)
Total Primary energy kWh/year			2601.7688 (286)
Dwelling Primary energy Rate (DPER)			20.1400 (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)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 334.7220 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1195 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3695 (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) = 0.3141 (21)

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Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infiltr rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.4004	0.3926	0.3847	0.3455	0.3376	0.2984	0.2984	0.2905	0.3141	0.3376	0.3533	0.3690	(22b)
	0.5802	0.5771	0.5740	0.5597	0.5570	0.5445	0.5445	0.5422	0.5493	0.5570	0.5624	0.5681	(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	
Main dwelling								
TER Opaque door			2.9300	1.0000	2.9300			(26)
TER Opening Type			25.5700	1.1450	29.2786			(27)
Ground Floor			46.9700	0.1300	6.1061			(28a)
Exposed Floor			2.3700	0.1300	0.3081			(28b)
GF	32.3200	11.5800	20.7400	0.1800	3.7332			(29a)
FF	26.6400	8.4900	18.1500	0.1800	3.2670			(29a)
SF	26.1100	8.4300	17.6800	0.1800	3.1824			(29a)
Main Roof	32.8800		32.8800	0.1100	3.6168			(30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214			(30)
Total net area of external elements Aum(A, m2)			182.0300					(31)
Fabric heat loss, W/K = Sum (A x U)					54.0436			(33)
Main dwelling								
Party Wall 1			55.9800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								93.2167 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	13.6730	0.0500	0.6837	
E3 Sill	9.5400	0.0500	0.4770	
E4 Jamb	50.1000	0.0500	2.5050	
E5 Ground floor (normal)	13.4700	0.1600	2.1552	
E6 Intermediate floor within a dwelling	14.7400	0.0000	0.0000	
E16 Corner (normal)	2.4000	0.0900	0.2160	
E18 Party wall between dwellings	26.4000	0.0600	1.5840	
E12 Gable (insulation at ceiling level)	10.8800	0.0600	0.6528	
E15 Flat roof with parapet	5.5900	0.5600	3.1304	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
E25 Staggered party wall between dwellings	2.4000	0.0600	0.1440	
E20 Exposed floor (normal)	1.9100	0.3200	0.6112	
E24 Eaves (insulation at ceiling level - inverted)	5.4400	0.2400	1.3056	
P1 Party wall - Ground floor	15.4800	0.0800	1.2384	
P2 Party wall - Intermediate floor within a dwelling	27.6080	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	12.1280	0.1200	1.4554	
P8 Party Wall - Exposed floor (inverted)	1.2400	0.2400	0.2976	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				16.2402 (36)
Point Thermal bridges				0.0000 (36a)
Total fabric heat loss				70.2838 (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	64.0856	63.7417	63.4046	61.8213	61.5250	60.1460	60.1460	59.8906	60.6772	61.5250	62.1243	62.7508	(38)
Average = Sum(39)m / 12 =	134.3694	134.0255	133.6884	132.1051	131.8089	130.4298	130.4298	130.1744	130.9610	131.8089	132.4081	133.0347	(39)
													132.1037

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0401	1.0374	1.0348	1.0226	1.0203	1.0096	1.0096	1.0076	1.0137	1.0203	1.0249	1.0298	(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													2.8929 (42)
Hot water usage for mixer showers													
72.7236	71.6307	70.0381	66.9910	64.7424	62.2347	60.8093	62.3898	64.1224	66.8149	69.9274	72.4449	72.4449	(42a)
Hot water usage for baths													
31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906	31.2906	(42b)
Hot water usage for other uses													
44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558	44.2558	(42c)
Average daily hot water use (litres/day)													136.3909 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
148.3761	145.2076	141.3491	135.4820	130.7175	125.5953	123.6269	127.4688	131.5206	136.8980	142.8555	147.9913	147.9913	(44)
Energy conte	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
35.2487	31.0161	32.5872	27.8202	26.3956	23.1651	22.4274	23.6749	24.3267	27.8654	30.5286	34.7578	34.7578	(46)
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(56)
If cylinder contains dedicated solar storage													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(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													
289.8982	256.3669	272.1551	238.6037	230.8777	207.5697	204.4229	212.7398	215.3136	240.6761	256.6594	286.6254	286.6254	(62)
WWHRS	-33.2462	-29.4032	-30.7893	-25.4948	-23.7602	-20.3318	-19.0578	-20.2661	-21.0361	-24.7992	-28.0945	-32.6305	(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	256.6521	226.9637	241.3658	213.1090	207.1175	187.2379	185.3650	192.4737	194.2775	215.8769	228.5649	253.9949	(64)
12Total per year (kWh/year)													2602.9989 (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	2603 (64a)

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Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
 Heat gains from water heating, kWh/month
 122.0601 108.4268 116.1605 104.1766 102.4358 93.8578 93.6395 96.4049 96.4327 105.6937 110.1801 120.9719 (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	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.8956	167.0630	150.8956	155.9255	150.8956	155.9255	150.8956	150.8956	155.9255	150.8956	155.9255	150.8956	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.7416	299.8209	292.0613	275.5420	254.6894	235.0908	221.9978	218.9185	226.6781	243.1974	264.0501	283.6486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	(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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	(71)
Water heating gains (Table 5)	164.0593	161.3495	156.1297	144.6898	137.6825	130.3581	125.8596	129.5765	133.9343	142.0614	153.0280	162.5966	(72)
Total internal gains	681.0894	697.6262	668.4795	645.5501	612.6603	587.7672	565.1459	565.7835	582.9308	605.5474	642.3964	666.5337	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Southeast					13.4600	36.7938	0.6300	0.7000	0.7700		151.3533
Northwest					12.1100	11.2829	0.6300	0.7000	0.7700		41.7579
Solar gains	193.1112	342.8100	505.8896	688.5744	827.6258	846.4339	805.7349	698.2059	568.5569	388.8117	233.8286
Total gains	874.2006	1040.4363	1174.3691	1334.1246	1440.2861	1434.2011	1370.8807	1263.9894	1151.4877	994.3590	876.2250
											163.6285 (83)
											830.1622 (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	24.8954	24.9593	25.0223	25.3222	25.3791	25.6474	25.6474	25.6977	25.5434	25.3791	25.2642	25.1452	
alpha	2.6597	2.6640	2.6682	2.6881	2.6919	2.7098	2.7098	2.7132	2.7029	2.6919	2.6843	2.6763	
util living area	0.9486	0.9203	0.8769	0.7910	0.6681	0.5172	0.3947	0.4387	0.6367	0.8334	0.9236	0.9544	(86)
MIT	18.5757	18.9411	19.4398	20.0629	20.5448	20.8388	20.9431	20.9232	20.7049	20.0639	19.2227	18.5181	(87)
Th 2	20.0501	20.0523	20.0544	20.0646	20.0665	20.0753	20.0753	20.0770	20.0719	20.0665	20.0626	20.0586	(88)
util rest of house	0.9418	0.9101	0.8611	0.7643	0.6262	0.4571	0.3194	0.3613	0.5786	0.8058	0.9121	0.9484	(89)
MIT 2	17.2069	17.6666	18.2899	19.0569	19.6214	19.9450	20.0411	20.0282	19.8146	19.0772	18.0343	17.1393	(90)
Living area fraction	17.3740	17.8221	18.4303	19.1797	19.7341	20.0541	20.1512	20.1374	19.9233	19.1976	18.1793	17.3076	(91)
MIT	17.3740	17.8221	18.4303	19.1797	19.7341	20.0541	20.1512	20.1374	19.9233	19.1976	18.1793	17.3076	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.3740	17.8221	18.4303	19.1797	19.7341	20.0541	20.1512	20.1374	19.9233	19.1976	18.1793	17.3076	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9149	0.8785	0.8273	0.7353	0.6099	0.4556	0.3258	0.3666	0.5685	0.7749	0.8812	0.9231	(94)
Ext temp.	799.7876	914.0106	971.5444	980.9736	878.4657	653.4564	446.6862	463.4092	654.5670	770.5040	772.1635	766.3190	(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	1756.7416	1731.8978	1594.9398	1358.0056	1058.9654	711.3761	463.1882	486.5165	762.6272	1133.2421	1466.9944	1743.7632	(97)
Space heating requirement - total per year (kWh/year)	711.9738	549.6203	463.8062	271.4631	134.2917	0.0000	0.0000	0.0000	0.0000	269.8772	500.2782	727.2185	(98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	711.9738	549.6203	463.8062	271.4631	134.2917	0.0000	0.0000	0.0000	0.0000	269.8772	500.2782	727.2185	(98c)
Space heating per m2													(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 %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating efficiency (main heating system 1)	711.9738	549.6203	463.8062	271.4631	134.2917	0.0000	0.0000	0.0000	0.0000	269.8772	500.2782	727.2185	(98)
Space heating fuel (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 efficiency (main heating system 2)	771.3692	595.4716	502.4986	294.1095	145.4948	0.0000	0.0000	0.0000	0.0000	292.3913	542.0132	787.8857	(211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)

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0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	256.6521	226.9637	241.3658	213.1090	207.1175	187.2379	185.3650	192.4737	194.2775	215.8769	228.5649	253.9949	(64)
Efficiency of water heater													
(217)m	86.2234	85.9664	85.4995	84.6036	83.1134	79.8000	79.8000	79.8000	79.8000	84.5616	85.7666	79.8000	(216)
Fuel for water heating, kWh/month													
	297.6595	264.0144	282.3009	251.8910	249.1986	234.6339	232.2870	241.1951	243.4556	255.2895	266.4965	294.3808	(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													
	31.3531	25.1526	22.6472	16.5923	12.8164	10.4711	11.6915	15.1971	19.7395	25.8993	29.2532	32.2245	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.9623	-63.9234	-92.6306	-104.9853	-113.8512	-106.4195	-105.0231	-98.7849	-87.9537	-73.3874	-49.5884	-38.8034	(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	-23.8110	-50.2628	-100.2466	-151.0966	-200.3473	-201.5784	-199.2903	-168.5581	-123.2509	-72.1575	-31.8743	-18.8232	(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												3931.2340	(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												3112.8029	(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)												253.0377	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2321.6100	(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												5061.4646	(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	3931.2340	0.2100	825.5591 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3112.8029	0.2100	653.6886 (264)
Space and water heating			1479.2477 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	253.0377	0.1443	36.5212 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-980.3130	0.1344	-131.7860
PV Unit electricity exported	-1341.2969	0.1258	-168.7108
Total			-300.4968 (269)
Total CO2, kg/year			1227.2014 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5000 (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	3931.2340	1.1300	4442.2944 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3112.8029	1.1300	3517.4673 (278)
Space and water heating			7959.7617 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	253.0377	1.5338	388.1177 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-980.3130	1.4968	-1467.3635
PV Unit electricity exported	-1341.2969	0.4617	-619.2763
Total			-2086.6398 (283)
Total Primary energy kWh/year			6391.3404 (286)
Target Primary Energy Rate (TPER)			49.4700 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			

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Ground floor	46.9700 (1b)	x	2.4000 (2b)	=	112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x	2.7000 (2c)	=	133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x	2.7000 (2d)	=	88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	334.7220 (5)

2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												40.0000 / (5) =	0.1195 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												3.0000 (17)	
Infiltration rate												0.2695 (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) =	0.2291 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
	0.2921	0.2863	0.2806	0.2520	0.2463	0.2176	0.2176	0.2119	0.2291	0.2463	0.2577	0.2692	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.0000 (23c)
Effective ac	0.5427	0.5410	0.5394	0.5317	0.5303	0.5237	0.5237	0.5224	0.5262	0.5303	0.5332	0.5362	(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	
Main dwelling								
Windows / Glazed Doors			25.5700	1.1450	29.2786			(27)
Door			2.9300	1.2000	3.5160			(26)
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000	(28a)
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000	(28b)
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200	(29a)
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000	(29a)
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400	(29a)
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200	(30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600	(30)
Total net area of external elements Aum(A, m2)			182.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.4391			(33)
Main dwelling								
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000	(32)
GF - Internal Wall 1			84.5100			9.0000	760.5900	(32c)
FF - Internal Wall 2			94.5800			9.0000	851.2200	(32c)
SF Internal Wall 3			54.9300			9.0000	494.3700	(32c)
Internal Floor 1			46.9700			18.0000	845.4600	(32d)
Internal Floor 2			32.8800			18.0000	591.8400	(32d)
Internal Ceiling 1			46.9700			9.0000	422.7300	(32e)
Internal Ceiling 2			32.8800			9.0000	295.9200	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12042.6700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.2167	(35)
Thermal bridges (User defined value 0.070 * total exposed area)							12.7421	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		65.1812	(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	59.9405	59.7576	59.5783	58.7360	58.5784	57.8448	57.8448	57.7089	58.1273	58.5784	58.8972	59.2305 (38)
Average = Sum(39)m / 12 =	125.1218	124.9388	124.7595	123.9172	123.7596	123.0260	123.0260	122.8901	123.3086	123.7596	124.0784	124.4117 (39)
												123.9164
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9685	0.9671	0.9657	0.9592	0.9580	0.9523	0.9523	0.9512	0.9545	0.9580	0.9604	0.9630 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8929 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906 (42b)
Hot water usage for other uses	44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558 (42c)
Average daily hot water use (litres/day)												69.3422 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	75.6525	73.5769	71.3110	68.4910	65.9751	63.3606	62.8176	65.0790	67.3982	70.0831	72.9281	75.5464 (44)
Energy content (annual)	119.8151	104.7726	109.6023	93.7607	88.8152	77.9092	75.9725	80.5813	83.1087	95.1022	103.8994	118.2874 (45)
	Total = Sum(45)m =											1151.6267

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (or HIU 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)
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 (57)
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 (59)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	101.8428	89.0567	93.1620	79.6966	75.4929	66.2229	64.5766	68.4941	70.6424	80.8368	88.3145	100.5443 (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	101.8428	89.0567	93.1620	79.6966	75.4929	66.2229	64.5766	68.4941	70.6424	80.8368	88.3145	100.5443 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											978.8827 (64)
Electric shower(s)	58.2395	51.8918	56.6639	54.0737	55.0883	52.5489	54.3006	55.0883	54.0737	56.6639	55.5984	58.2395 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											662.4705 (64a)
Heat gains from water heating, kWh/month	40.0206	35.2371	37.4565	33.4426	32.6453	29.6929	29.7193	30.8956	31.1790	34.3752	35.9782	39.6959 (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	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	144.6430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.8956	167.0630	150.8956	155.9255	150.8956	155.9255	150.8956	150.8956	155.9255	150.8956	155.9255	150.8956	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.7416	299.8209	292.0613	275.5420	254.6894	235.0908	221.9978	218.9185	226.6781	243.1974	264.0501	283.6486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	(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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	(71)
Water heating gains (Table 5)	53.7911	52.4362	50.3447	46.4480	43.8781	41.2402	39.9453	41.5264	43.3042	46.2032	49.9698	53.3547	(72)
Total internal gains	567.8212	585.7130	559.6945	544.3084	515.8560	498.6494	479.2316	477.7334	492.3007	506.6891	536.3382	554.2919	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast					13.4600	36.7938	0.6000		0.7000		0.7700		144.1460 (77)	
Northwest					12.1100	11.2829	0.6000		0.7000		0.7700		39.7694 (81)	
Solar gains	183.9154	326.4857	481.7996	655.7852	788.2150	806.1275	767.3665	664.9580	541.4828	370.2968	222.6939	155.8366	(83)	
Total gains	751.7366	912.1987	1041.4941	1200.0936	1304.0710	1304.7769	1246.5981	1142.6914	1033.7835	876.9860	759.0321	710.1285	(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	26.7354	26.7746	26.8131	26.9953	27.0297	27.1909	27.1909	27.2209	27.1286	27.0297	26.9603	26.8880
alpha	2.7824	2.7850	2.7875	2.7997	2.8020	2.8127	2.8127	2.8147	2.8086	2.8020	2.7974	2.7925
util living area	0.9620	0.9364	0.8961	0.8125	0.6894	0.5358	0.4097	0.4577	0.6621	0.8583	0.9410	0.9671 (86)
MIT	18.5937	18.9607	19.4562	20.0734	20.5545	20.8435	20.9458	20.9250	20.7054	20.0551	19.2150	18.5233 (87)
Th 2	20.1097	20.1108	20.1120	20.1175	20.1185	20.1233	20.1233	20.1242	20.1214	20.1185	20.1164	20.1143 (88)
util rest of house	0.9569	0.9282	0.8826	0.7883	0.6497	0.4773	0.3359	0.3817	0.6067	0.8342	0.9320	0.9626 (89)
MIT 2	17.8928	18.2542	18.7387	19.3328	19.7745	20.0228	20.0971	20.0860	19.9174	19.3292	18.5130	17.8265 (90)
Living area fraction	fLA = Living area / (4) =											0.1221 (91)
MIT	17.9784	18.3404	18.8262	19.4232	19.8697	20.1230	20.2007	20.1884	20.0135	19.4178	18.5987	17.9115 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9784	18.3404	18.8262	19.4232	19.8697	20.1230	20.2007	20.1884	20.0135	19.4178	18.5987	17.9115 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	707.0188	827.6450	894.4592	919.9961	831.4794	622.8004	427.1234	442.7819	619.5718	711.6379	692.1606	672.9235	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1711.4624	1679.2280	1537.8155	1304.0017	1011.0795	679.4743	442.9845	465.5572	729.1914	1091.2847	1426.7437	1705.8762	(97)
Space heating kWh	747.3060	572.2637	478.6571	276.4840	133.6225	0.0000	0.0000	0.0000	0.0000	282.4572	528.8998	768.5168	(98a)
Space heating requirement - total per year (kWh/year)												3788.2072	
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	747.3060	572.2637	478.6571	276.4840	133.6225	0.0000	0.0000	0.0000	0.0000	282.4572	528.8998	768.5168	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3788.2072	
Space heating per m ²												29.3228	(99)

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8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1156.4444	910.3924	933.9651	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8168	0.8699	0.8402	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	944.6164	791.9828	784.7290	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1460.6590	1395.5804	1277.1449	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	371.5507	449.0766	366.3574	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	92.8877	112.2692	91.5894	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												296.7462 (107)
Energy for space heating												29.3228 (99)
Energy for space cooling												2.2970 (108)
Total												31.6197 (109)
Fabric Energy Efficiency (DFEE)												31.6 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	334.7220 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1195 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3695 (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) = 0.3141 (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	0.4004	0.3926	0.3847	0.3455	0.3376	0.2984	0.2984	0.2905	0.3141	0.3376	0.3533	0.3690 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5802	0.5771	0.5740	0.5597	0.5570	0.5445	0.5445	0.5422	0.5493	0.5570	0.5624	0.5681 (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
Main dwelling							
TER Opaque door			2.9300	1.0000	2.9300		(26)
TER Opening Type			25.5700	1.1450	29.2786		(27)
Ground Floor			46.9700	0.1300	6.1061		(28a)
Exposed Floor			2.3700	0.1300	0.3081		(28b)
GF	32.3200	11.5800	20.7400	0.1800	3.7332		(29a)
FF	26.6400	8.4900	18.1500	0.1800	3.2670		(29a)
SF	26.1100	8.4300	17.6800	0.1800	3.1824		(29a)
Main Roof	32.8800		32.8800	0.1100	3.6168		(30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214		(30)
Total net area of external elements Aum(A, m2)			182.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.0436		(33)
Main dwelling							
Party Wall 1			55.9800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.2167 (35)
List of Thermal Bridges							

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K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	13.6730	0.0500	0.6837
E3 Sill	9.5400	0.0500	0.4770
E4 Jamb	50.1000	0.0500	2.5050
E5 Ground floor (normal)	13.4700	0.1600	2.1552
E6 Intermediate floor within a dwelling	14.7400	0.0000	0.0000
E16 Corner (normal)	2.4000	0.0900	0.2160
E18 Party wall between dwellings	26.4000	0.0600	1.5840
E12 Gable (insulation at ceiling level)	10.8800	0.0600	0.6528
E15 Flat roof with parapet	5.5900	0.5600	3.1304
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E25 Staggered party wall between dwellings	2.4000	0.0600	0.1440
E20 Exposed floor (normal)	1.9100	0.3200	0.6112
E24 Eaves (insulation at ceiling level - inverted)	5.4400	0.2400	1.3056
P1 Party wall - Ground floor	15.4800	0.0800	1.2384
P2 Party wall - Intermediate floor within a dwelling	27.6080	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	12.1280	0.1200	1.4554
P8 Party Wall - Exposed floor (inverted)	1.2400	0.2400	0.2976
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			16.2402 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss		(33) + (36) + (36a) =	70.2838 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 64.0856	Feb 63.7417	Mar 63.4046	Apr 61.8213	May 61.5250	Jun 60.1460	Jul 60.1460	Aug 59.8906	Sep 60.6772	Oct 61.5250	Nov 62.1243	Dec 62.7508 (38)
Heat transfer coeff	134.3694	134.0255	133.6884	132.1051	131.8089	130.4298	130.4298	130.1744	130.9610	131.8089	132.4081	133.0347 (39)
Average = Sum(39)m / 12 =												132.1037
HLP	Jan 1.0401	Feb 1.0374	Mar 1.0348	Apr 1.0226	May 1.0203	Jun 1.0096	Jul 1.0096	Aug 1.0076	Sep 1.0137	Oct 1.0203	Nov 1.0249	Dec 1.0298 (40)
HLP (average)												1.0226
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.8929 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906 (42b)
Hot water usage for other uses	44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558 (42c)
Average daily hot water use (litres/day)												69.3422 (43)
Daily hot water use	Jan 75.6525	Feb 73.5769	Mar 71.3110	Apr 68.4910	May 65.9751	Jun 63.3606	Jul 62.8176	Aug 65.0790	Sep 67.3982	Oct 70.0831	Nov 72.9281	Dec 75.5464 (44)
Energy conte	119.8151	104.7726	109.6023	93.7607	88.8152	77.9092	75.9725	80.5813	83.1087	95.1022	103.8994	118.2874 (45)
Energy content (annual)										Total = Sum(45)m =		1151.6267
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (or HIU loss):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	101.8428	89.0567	93.1620	79.6966	75.4929	66.2229	64.5766	68.4941	70.6424	80.8368	88.3145	100.5443 (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	101.8428	89.0567	93.1620	79.6966	75.4929	66.2229	64.5766	68.4941	70.6424	80.8368	88.3145	100.5443 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		978.8827 (64)
Electric shower(s)	58.2395	51.8918	56.6639	54.0737	55.0883	52.5489	54.3006	55.0883	54.0737	56.6639	55.5984	58.2395 (64a)
Heat gains from water heating, kWh/month	40.0206	35.2371	37.4565	33.4426	32.6453	29.6929	29.7193	30.8956	31.1790	34.3752	35.9782	39.6959 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan 144.6430	Feb 144.6430	Mar 144.6430	Apr 144.6430	May 144.6430	Jun 144.6430	Jul 144.6430	Aug 144.6430	Sep 144.6430	Oct 144.6430	Nov 144.6430	Dec 144.6430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.8956	167.0630	150.8956	155.9255	150.8956	155.9255	150.8956	150.8956	155.9255	150.8956	155.9255	150.8956 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.7416	299.8209	292.0613	275.5420	254.6894	235.0908	221.9978	218.9185	226.6781	243.1974	264.0501	283.6486 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643	37.4643 (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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144 (71)
Water heating gains (Table 5)	53.7911	52.4362	50.3447	46.4480	43.8781	41.2402	39.9453	41.5264	43.3042	46.2032	49.9698	53.3547 (72)
Total internal gains	567.8212	585.7130	559.6945	544.3084	515.8560	498.6494	479.2316	477.7334	492.3007	506.6891	536.3382	554.2919 (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	
Southeast	13.4600	36.7938	0.6300	0.7000	0.7700	151.3533 (77)	

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Northwest 12.1100 11.2829 0.6300 0.7000 0.7700 41.7579 (81)

Solar gains 193.1112 342.8100 505.8896 688.5744 827.6258 846.4339 805.7349 698.2059 568.5569 388.8117 233.8286 163.6285 (83)
Total gains 760.9324 928.5230 1065.5841 1232.8828 1343.4817 1345.0833 1284.9664 1175.9393 1060.8576 895.5008 770.1668 717.9203 (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	24.8954	24.9593	25.0223	25.3222	25.3791	25.6474	25.6474	25.6977	25.5434	25.3791	25.2642	25.1452
alpha	2.6597	2.6640	2.6682	2.6881	2.6919	2.7098	2.7098	2.7132	2.7029	2.6919	2.6843	2.6763
util living area	0.9620	0.9369	0.8973	0.8154	0.6949	0.5427	0.4173	0.4656	0.6691	0.8609	0.9415	0.9670 (86)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MIT	18.4091	18.7908	19.3134	19.9766	20.4955	20.8183	20.9348	20.9110	20.6645	19.9643	19.0777	18.3494 (87)
Th 2	20.0501	20.0523	20.0544	20.0646	20.0665	20.0753	20.0753	20.0770	20.0719	20.0665	20.0626	20.0586 (88)
util rest of house	0.9568	0.9284	0.8835	0.7905	0.6538	0.4814	0.3389	0.3852	0.6116	0.8363	0.9323	0.9624 (89)
MIT 2	17.6711	18.0475	18.5595	19.2014	19.6791	19.9599	20.0445	20.0324	19.8413	19.2052	18.3420	17.6178 (90)
Living area fraction									fLA = Living area / (4) =			0.1221 (91)
MIT	17.7612	18.1382	18.6515	19.2961	19.7788	20.0647	20.1532	20.1397	19.9418	19.2979	18.4318	17.7071 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7612	18.1382	18.6515	19.2961	19.7788	20.0647	20.1532	20.1397	19.9418	19.2979	18.4318	17.7071 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9395	0.9063	0.8581	0.7669	0.6400	0.4807	0.3458	0.3909	0.6028	0.8119	0.9111	0.9466 (94)
Useful gains	714.9309	841.5571	914.3765	945.4945	859.7819	646.5351	444.3162	459.7216	639.4389	727.0187	701.7277	679.6090 (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	1808.7688	1774.2604	1624.5127	1373.3745	1064.8522	712.7561	463.4382	486.8115	765.0474	1146.4561	1500.4281	1796.9145 (97)
Space heating kWh	813.8154	626.7766	528.3413	308.0736	152.5723	0.0000	0.0000	0.0000	0.0000	312.0614	575.0643	831.2753 (98a)
Space heating requirement - total per year (kWh/year)												4147.9802
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	813.8154	626.7766	528.3413	308.0736	152.5723	0.0000	0.0000	0.0000	0.0000	312.0614	575.0643	831.2753 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4147.9802
Space heating per m2										(98c) / (4) =		32.1076 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1226.0403	965.1807	989.3258	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8009	0.8559	0.8248	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	981.9170	826.0758	816.0122	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1507.7703	1440.4265	1316.0061	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	378.6144	457.0770	371.9954	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	94.6536	114.2692	92.9989	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												301.9217 (107)
Energy for space heating												32.1076 (99)
Energy for space cooling												2.3370 (108)
Total												34.4446 (109)
Fabric Energy Efficiency (TFEE)												34.4 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	334.7220 (5)

2. Ventilation rate

Number of open chimneys 0 * 80 = 0.0000 (6a)

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 3.0000 (17)
Infiltration rate 0.1500 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 71.1000 (23c)

Effective ac	0.3071	0.3039	0.3007	0.2847	0.2816	0.2656	0.2656	0.2624	0.2720	0.2816	0.2879	0.2943 (25)
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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Windows / Glazed Doors			25.5700	1.1450	29.2786		(27)
Door			2.9300	1.2000	3.5160		(26)
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000 (28a)
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000 (28b)
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200 (29a)
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000 (29a)
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400 (29a)
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200 (30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600 (30)
Total net area of external elements Aum(A, m2)			182.0300				(31)
Fabric heat loss, W/K = Sum (A x U)					52.4391		(33)
Main dwelling							
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000 (32)
GF - Internal Wall 1			84.5100			9.0000	760.5900 (32c)
FF - Internal Wall 2			94.5800			9.0000	851.2200 (32c)
SF Internal Wall 3			54.9300			9.0000	494.3700 (32c)
Internal Floor 1			46.9700			18.0000	845.4600 (32d)
Internal Floor 2			32.8800			18.0000	591.8400 (32d)
Internal Ceiling 1			46.9700			9.0000	422.7300 (32e)
Internal Ceiling 2			32.8800			9.0000	295.9200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12042.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.2167 (35)
Thermal bridges (User defined value 0.070 * total exposed area)							12.7421 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	65.1812 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	33.9176	33.5655	33.2134	31.4530	31.1009	29.3405	29.3405	28.9884	30.0446	31.1009	31.8051	32.5092 (38)
Heat transfer coeff	99.0988	98.7467	98.3946	96.6342	96.2821	94.5217	94.5217	94.1696	95.2259	96.2821	96.9863	97.6905 (39)
Average = Sum(39)m / 12 =												96.5462

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7671	0.7644	0.7616	0.7480	0.7453	0.7316	0.7316	0.7289	0.7371	0.7453	0.7507	0.7562 (40)
HLP (average)												0.7473
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8929 (42)

Hot water usage for mixer showers	72.7236	71.6307	70.0381	66.9910	64.7424	62.2347	60.8093	62.3898	64.1224	66.8149	69.9274	72.4449 (42a)
Hot water usage for baths	31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906 (42b)
Hot water usage for other uses	44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558 (42c)
Average daily hot water use (litres/day)												136.3909 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.3761	145.2076	141.3491	135.4820	130.7175	125.5953	123.6269	127.4688	131.5206	136.8980	142.8555	147.9913 (44)
Energy conte	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186 (45)
Energy content (annual)												2265.4253
Distribution loss (46)m = 0.15 x (45)m	35.2487	31.0161	32.5872	27.8202	26.3956	23.1651	22.4274	23.6749	24.3267	27.8654	30.5286	34.7578 (46)
Water storage loss (or HIU loss):												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034 (56)
If cylinder contains dedicated solar storage	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844	(64)
	Total per year (kWh/year) = Sum(64)m =											2817.2323	(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													
	115.6273	102.6166	109.7277	97.9514	96.0030	87.6325	87.2067	89.9721	90.2074	99.2609	103.9549	114.5391	(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	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.2167	31.2791	25.4379	19.2581	14.3957	12.1534	13.1322	17.0698	22.9110	29.0908	33.9532	36.1955	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.8980	447.4939	435.9124	411.2567	380.1334	350.8818	331.3400	326.7441	338.3256	362.9812	394.1046	423.3561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	(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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	(71)
Water heating gains (Table 5)	155.4130	152.7032	147.4835	136.0435	129.0362	121.7118	117.2133	120.9302	125.2880	133.4152	144.3817	153.9504	(72)
Total internal gains	746.6349	744.5835	721.9410	679.6656	636.6725	597.8543	574.7928	577.8513	599.6318	638.5944	685.5468	726.6092	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Southeast					13.4600	36.7938	0.6000	0.7000	0.7700	144.1460 (77)		
Northwest					12.1100	11.2829	0.6000	0.7000	0.7700	39.7694 (81)		

Solar gains	183.9154	326.4857	481.7996	655.7852	788.2150	806.1275	767.3665	664.9580	541.4828	370.2968	222.6939	155.8366 (83)
Total gains	930.5503	1071.0692	1203.7406	1335.4508	1424.8875	1403.9818	1342.1593	1242.8093	1141.1146	1008.8913	908.2406	882.4458 (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	33.7561	33.8764	33.9976	34.6170	34.7436	35.3907	35.3907	35.5230	35.1290	34.7436	34.4913	34.2427	
alpha	3.2504	3.2584	3.2665	3.3078	3.3162	3.3594	3.3594	3.3682	3.3419	3.3162	3.2994	3.2828	
util living area	0.9263	0.8893	0.8260	0.7145	0.5706	0.4160	0.3057	0.3420	0.5333	0.7654	0.8915	0.9352	(86)
Living	19.4855	19.7815	20.1724	20.5859	20.8412	20.9595	20.9891	20.9841	20.9063	20.5584	19.9646	19.4345	
Non living	18.8891	19.1778	19.5545	19.9502	20.1787	20.2865	20.3074	20.3069	20.2433	19.9356	19.3696	18.8467	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2252	19.7815	20.1724	20.5859	20.8412	20.9595	20.9891	20.9841	20.9063	20.5584	19.9646	19.6535	(87)
Th 2	20.2820	20.2843	20.2867	20.2986	20.3010	20.3130	20.3130	20.3154	20.3082	20.3010	20.2962	20.2915	(88)
util rest of house	0.9182	0.8780	0.8091	0.6893	0.5367	0.3749	0.2593	0.2932	0.4887	0.7379	0.8786	0.9280	(89)
MIT 2	19.5694	19.1778	19.5545	19.9502	20.1787	20.2865	20.3074	20.3069	20.2433	19.9356	19.3696	19.0488	(90)
Living area fraction									fLA = Living area / (4) =			0.1221	(91)
MIT	19.6495	19.2515	19.6299	20.0278	20.2596	20.3687	20.3906	20.3896	20.3242	20.0116	19.4422	19.1226	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6495	19.2515	19.6299	20.0278	20.2596	20.3687	20.3906	20.3896	20.3242	20.0116	19.4422	19.1226	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	847.0758	920.2556	953.2646	906.7186	761.7192	531.1315	355.1763	371.0103	558.8272	731.9460	781.4283	806.5840	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1521.1160	1417.1640	1291.9099	1075.3240	824.1359	545.2672	358.2947	375.6968	592.7032	906.1689	1197.0251	1457.7978	(97)
Space heating kWh	501.4859	333.9224	251.9521	121.3959	46.4380	0.0000	0.0000	0.0000	0.0000	129.6219	299.2297	484.5031	(98a)
Space heating requirement - total per year (kWh/year)												2168.5491	
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	501.4859	333.9224	251.9521	121.3959	46.4380	0.0000	0.0000	0.0000	0.0000	129.6219	299.2297	484.5031	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2168.5491	
Space heating per m2												16.7857	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													249.2796 (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	501.4859	333.9224	251.9521	121.3959	46.4380	0.0000	0.0000	0.0000	0.0000	129.6219	299.2297	484.5031	(98)
Space heating efficiency (main heating system 1)	249.2796	249.2796	249.2796	249.2796	249.2796	0.0000	0.0000	0.0000	0.0000	249.2796	249.2796	249.2796	(210)
Space heating fuel (main heating system)	201.1741	133.9550	101.0721	48.6987	18.6289	0.0000	0.0000	0.0000	0.0000	51.9986	120.0378	194.3613	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844	(64)
Efficiency of water heater (217)m	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	(216)
Fuel for water heating, kWh/month	166.2286	146.9121	155.7644	136.1301	131.4206	117.8274	115.8185	120.7235	122.3944	137.1993	146.7786	164.2984	(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	37.7174	34.0674	37.7174	36.5007	37.7174	36.5007	37.7174	37.7174	36.5007	37.7174	36.5007	37.7174	(231)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-48.3531	-73.1737	-114.0890	-137.2721	-154.2646	-144.8098	-142.2588	-129.9168	-108.5024	-85.4593	-54.2390	-41.0856	(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	-16.0333	-37.4440	-85.0301	-148.8133	-218.6119	-230.4589	-224.3336	-176.8585	-116.4606	-58.6379	-22.7055	-12.4378	(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													869.9263 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													169.5600
Water heating fuel used													1661.4958 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)													
mechanical ventilation fans (SFP = 1.0875)													444.0924 (230a)
Total electricity for the above, kWh/year													444.0924 (231)
Electricity for lighting (calculated in Appendix L)													248.7750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2581.2496 (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													643.0400 (238)

10a. Fuel costs - using Table 12 prices													
		Fuel							Fuel price			Fuel cost	
		kWh/year							p/kWh			£/year	
Space heating - main system 1		869.9263							16.4900			143.4508	(240)
Total CO2 associated with community systems												0.0000	(473)
Water heating (other fuel)									16.4900			273.9807	(247)
Energy for instantaneous electric shower(s)									16.4900			0.0000	(247a)
Pumps, fans and electric keep-hot									16.4900			73.2308	(249)
Energy for lighting									16.4900			41.0230	(250)
Additional standing charges												0.0000	(251)
Energy saving/generation technologies													
PV Unit electricity used in dwelling									-1233.4242			16.4900	-203.3917
PV Unit electricity exported									-1347.8254			5.5900	-75.3434
Total													-278.7351 (252)
Total energy cost													252.9503 (255)

11a. SAP rating - Individual heating systems													
Energy cost deflator (Table 12):													0.3600 (256)
Energy cost factor (ECF)													0.5228 (257)
SAP value													91.5258
SAP rating (Section 12)													92 (258)
SAP band													A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP													
		Energy							Emission factor			Emissions	
		kWh/year							kg CO2/kWh			kg CO2/year	
Space heating - main system 1		869.9263							0.1563			135.9895	(261)
Total CO2 associated with community systems												0.0000	(373)

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Water heating (other fuel)	1661.4958	0.1410	234.2989 (264)
Space and water heating			370.2884 (265)
Pumps, fans and electric keep-hot	444.0924	0.1387	61.6011 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1233.4242	0.1334	-164.5032
PV Unit electricity exported	-1347.8254	0.1223	-164.8119
Total			-329.3150 (269)
Total CO2, kg/year			138.4804 (272)
CO2 emissions per m2			1.0700 (273)
EI value			98.9347
EI rating			99 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)
Main dwelling					
Ground floor	46.9700 (1b)	x	2.4000 (2b)	=	112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x	2.7000 (2c)	=	133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x	2.7000 (2d)	=	88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	334.7220 (5)

2. Ventilation rate

													m3 per hour
Number of open chimneys													0 * 80 = 0.0000 (6a)
Number of open flues													0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire													0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler													0 * 20 = 0.0000 (6d)
Number of flues attached to other heater													0 * 35 = 0.0000 (6e)
Number of blocked chimneys													0 * 20 = 0.0000 (6f)
Number of intermittent extract fans													0 * 10 = 0.0000 (7a)
Number of passive vents													0 * 10 = 0.0000 (7b)
Number of flueless gas fires													0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans													Air changes per hour
Pressure test													0.0000 / (5) = 0.0000 (8)
Pressure Test Method													Yes
Measured/design AP50													Blower Door
Infiltration rate													3.0000 (17)
Number of sides sheltered													0.1500 (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) = 0.1275 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000	(22)
Adj infilt rate	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750	(22a)
	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													71.1000 (23c)
Effective ac	0.3102	0.3102	0.3039	0.2847	0.2816	0.2688	0.2624	0.2624	0.2752	0.2911	0.2975	0.2943	(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
Main dwelling							
Windows / Glazed Doors			25.5700	1.1450	29.2786		(27)
Door			2.9300	1.2000	3.5160		(26)
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000 (28a)
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000 (28b)
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200 (29a)
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000 (29a)
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400 (29a)
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200 (30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600 (30)
Total net area of external elements Aum(A, m2)			182.0300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.4391		(33)
Main dwelling							
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000 (32)
GF - Internal Wall 1			84.5100			9.0000	760.5900 (32c)
FF - Internal Wall 2			94.5800			9.0000	851.2200 (32c)
SF Internal Wall 3			54.9300			9.0000	494.3700 (32c)
Internal Floor 1			46.9700			18.0000	845.4600 (32d)
Internal Floor 2			32.8800			18.0000	591.8400 (32d)
Internal Ceiling 1			46.9700			9.0000	422.7300 (32e)
Internal Ceiling 2			32.8800			9.0000	295.9200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12042.6700 (34)

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tau	33.6366	33.6366	33.8764	34.6170	34.7436	35.2593	35.5230	35.5230	34.9996	34.3666	34.1197	34.2427
alpha	3.2424	3.2424	3.2584	3.3078	3.3162	3.3506	3.3682	3.3682	3.3333	3.2911	3.2746	3.2828
util living area	0.9336	0.9010	0.8449	0.7357	0.6041	0.4915	0.4070	0.4491	0.6111	0.8044	0.9046	0.9416 (86)
Living	19.3821	19.6528	20.0417	20.5078	20.7913	20.9178	20.9643	20.9512	20.8307	20.4221	19.8418	19.3309
Non living	18.7858	19.0487	19.4269	19.8770	20.1349	20.2516	20.2926	20.2837	20.1788	19.8035	19.2450	18.7445
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1723	19.6528	20.0417	20.5078	20.7913	20.9178	20.9643	20.9512	20.8307	20.4221	19.8418	19.5643 (87)
Th 2	20.2796	20.2796	20.2843	20.2986	20.3010	20.3106	20.3154	20.3154	20.3058	20.2939	20.2891	20.2915 (88)
util rest of house	0.9264	0.8910	0.8301	0.7131	0.5731	0.4538	0.3647	0.4044	0.5720	0.7811	0.8932	0.9353 (89)
MIT 2	19.5154	19.0487	19.4269	19.8770	20.1349	20.2516	20.2926	20.2837	20.1788	19.8035	19.2450	18.9609 (90)
Living area fraction									fLA = Living area / (4) =			0.1221 (91)
MIT	19.5956	19.1224	19.5019	19.9540	20.2150	20.3329	20.3746	20.3652	20.2584	19.8790	19.3179	19.0346 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5956	19.1224	19.5019	19.9540	20.2150	20.3329	20.3746	20.3652	20.2584	19.8790	19.3179	19.0346 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9187	0.8721	0.8119	0.7012	0.5692	0.4550	0.3684	0.4077	0.5693	0.7660	0.8750	0.9218 (94)
Useful gains	838.8457	923.9654	979.6854	962.8660	832.4590	645.9002	503.3210	507.1890	648.5055	760.8616	780.9689	802.7793 (95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000 (96)
Heat loss rate W	1560.9431	1474.1051	1372.7686	1164.8307	916.1270	676.7240	515.5406	524.0686	712.8592	990.8045	1246.8937	1498.0429 (97)
Space heating kWh	537.2405	369.6939	292.4540	145.4146	62.2490	0.0000	0.0000	0.0000	0.0000	171.0775	335.4659	517.2761 (98a)
Space heating requirement - total per year (kWh/year)												2430.8714
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	537.2405	369.6939	292.4540	145.4146	62.2490	0.0000	0.0000	0.0000	0.0000	171.0775	335.4659	517.2761 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2430.8714
Space heating per m2										(98c) / (4) =		18.8163 (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 %)												249.1877 (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	537.2405	369.6939	292.4540	145.4146	62.2490	0.0000	0.0000	0.0000	0.0000	171.0775	335.4659	517.2761 (98)
Space heating efficiency (main heating system 1)	249.1877	249.1877	249.1877	249.1877	249.1877	0.0000	0.0000	0.0000	0.0000	249.1877	249.1877	249.1877 (210)
Space heating fuel (main heating system)	215.5967	148.3596	117.3629	58.3555	24.9808	0.0000	0.0000	0.0000	0.0000	68.6541	134.6238	207.5849 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	281.8573	249.1041	264.1141	230.8221	222.8367	199.7881	196.3819	204.6988	207.5320	232.6351	248.8778	278.5844 (64)
Efficiency of water heater (217)m	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600 (216)
Fuel for water heating, kWh/month	166.2286	146.9121	155.7644	136.1301	131.4206	117.8274	115.8185	120.7235	122.3944	137.1993	146.7786	164.2984 (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	37.7174	34.0674	37.7174	36.5007	37.7174	36.5007	37.7174	37.7174	36.5007	37.7174	36.5007	37.7174 (231)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-44.1486	-70.8710	-114.5998	-142.4267	-158.7207	-145.9292	-144.2111	-129.6002	-107.6760	-82.8411	-50.8726	-38.2198 (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	-13.5889	-34.7705	-83.8473	-157.9460	-230.0393	-235.0317	-232.2524	-175.8447	-114.5673	-53.8374	-19.9885	-10.8991 (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												975.5182 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.5600
Water heating fuel used												1661.4958 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)												
mechanical ventilation fans (SFP = 1.0875)												444.0924 (230a)
Total electricity for the above, kWh/year												444.0924 (231)
Electricity for lighting (calculated in Appendix L)												248.7750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2592.7302 (233)
Wind generation												0.0000 (234)

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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	737.1513 (238)

10a. Fuel costs - using BEDF prices (585)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	975.5182	28.4300	277.3398 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1661.4958	28.4300	472.3633 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	444.0924	28.4300	126.2555 (249)
Energy for lighting	248.7750	28.4300	70.7267 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1230.1170	28.4300	-349.7223
PV Unit electricity exported	-1362.6132	5.8100	-79.1678
Total			-428.8901 (252)
Total energy cost			517.7952 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	975.5182	0.1558	151.9801 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1661.4958	0.1410	234.2989 (264)
Space and water heating			386.2790 (265)
Pumps, fans and electric keep-hot	444.0924	0.1387	61.6011 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1230.1170	0.1331	-163.7361
PV Unit electricity exported	-1362.6132	0.1218	-165.9752
Total			-329.7113 (269)
Total CO2, kg/year			154.0746 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	975.5182	1.5767	1538.1439 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1661.4958	1.5214	2527.8577 (278)
Space and water heating			4066.0016 (279)
Pumps, fans and electric keep-hot	444.0924	1.5128	671.8230 (281)
Energy for lighting	248.7750	1.5338	381.5794 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1230.1170	1.4919	-1835.1732
PV Unit electricity exported	-1362.6132	0.4469	-608.9980
Total			-2444.1712 (283)
Total Primary energy kWh/year			2675.2328 (286)

SAP 10 EPC IMPROVEMENTS

Type B

Current energy efficiency rating:	A 92
Current environmental impact rating:	A 99

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.6	-£ 82	-40 kg (26.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£82	0.31 kg/m²	A 93
Total Savings	£82	0.31 kg/m²	A 99

Potential energy efficiency rating:	A 93
Potential environmental impact rating:	A 99

Fuel prices for cost data on this page from database revision number 585 TEST (31 Oct 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):	Current	Potential	Saving
Electricity	£947	£854	£93
Space heating	£404	£427	-£23
Water heating	£472	£356	£116
Lighting	£71	£71	£0
Generated (PV)	-£429	-£418	-£11

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Total cost of fuels	£518	£436	£82
Total cost of uses	£518	£436	£82
Delivered energy	6 kWh/m ²	3 kWh/m ²	3 kWh/m ²
Carbon dioxide emissions	0.2 tonnes	0.1 tonnes	0.0 tonnes
CO2 emissions per m ²	1 kg/m ²	1 kg/m ²	0 kg/m ²
Primary energy	21 kWh/m ²	17 kWh/m ²	3 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	334.7220 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.1626 0.1594 0.1562 0.1403 0.1371 0.1211 0.1211 0.1179 0.1275 0.1371 0.1434 0.1498 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	71.1000 (23c)
Effective ac	0.3071 0.3039 0.3007 0.2847 0.2816 0.2656 0.2656 0.2624 0.2720 0.2816 0.2879 0.2943 (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
Main dwelling							
Windows / Glazed Doors			25.5700	1.1450	29.2786		(27)
Door			2.9300	1.2000	3.5160		(26)
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000 (28a)
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000 (28b)
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200 (29a)
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000 (29a)
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400 (29a)
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200 (30)
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600 (30)
Total net area of external elements Aum(A, m ²)			182.0300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	52.4391	(33)
Main dwelling							
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000 (32)
GF - Internal Wall 1			84.5100			9.0000	760.5900 (32c)
FF - Internal Wall 2			94.5800			9.0000	851.2200 (32c)
SF Internal Wall 3			54.9300			9.0000	494.3700 (32c)
Internal Floor 1			46.9700			18.0000	845.4600 (32d)
Internal Floor 2			32.8800			18.0000	591.8400 (32d)
Internal Ceiling 1			46.9700			9.0000	422.7300 (32e)
Internal Ceiling 2			32.8800			9.0000	295.9200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12042.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							93.2167 (35)
Thermal bridges (User defined value 0.070 * total exposed area)							12.7421 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	65.1812 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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(38)m	33.9176	33.5655	33.2134	31.4530	31.1009	29.3405	29.3405	28.9884	30.0446	31.1009	31.8051	32.5092 (38)
Heat transfer coeff	99.0988	98.7467	98.3946	96.6342	96.2821	94.5217	94.5217	94.1696	95.2259	96.2821	96.9863	97.6905 (39)
Average = Sum(39)m / 12 =												96.5462

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.7671	0.7644	0.7616	0.7480	0.7453	0.7316	0.7316	0.7289	0.7371	0.7453	0.7507	0.7562 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8929 (42)
Hot water usage for mixer showers													
72.7236	71.6307	70.0381	66.9910	64.7424	62.2347	60.8093	62.3898	64.1224	66.8149	69.9274	72.4449	(42a)	
Hot water usage for baths													
31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906	(42b)	
Hot water usage for other uses													
44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558	(42c)	
Average daily hot water use (litres/day)												136.3909 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
148.3761	145.2076	141.3491	135.4820	130.7175	125.5953	123.6269	127.4688	131.5206	136.8980	142.8555	147.9913	(44)	
Energy content (annual)	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2265.4253	
35.2487	31.0161	32.5872	27.8202	26.3956	23.1651	22.4274	23.6749	24.3267	27.8654	30.5286	34.7578	(46)	
Water storage loss (or HIU loss):													
Store volume												250.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.4100 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.7614 (55)	
Total storage loss													
23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	(56)	
If cylinder contains dedicated solar storage													
23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month													
281.8573	249.1041	262.7184	224.0685	210.0424	187.1813	183.3549	192.6023	202.1291	231.2393	248.8778	278.5844	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.8000 (H2)	
Collector linear heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0000 (H4)	
Collector loop efficiency												0.9000 (H5)	
Incidence angle modifier												1.0000 (H6)	
Overshading factor												0.8000 (H8)	
Overall heat loss coefficient of system												6.5000 (H10)	
Heat loss coefficient of collector loop												3.9667 (H11)	
Dedicated solar storage volume												75.0000 (H12)	
Effective solar volume												75.0000 (H14)	
Reference volume												225.0000 (H15)	
Storage tank correction coefficient												1.3161 (H16)	
Heat delivered to hot water												626.1235 (H24)	
Heat delivered to space heating												0.0000 (H29)	
Solar input												626.1235	
Solar input	-0.0000	-16.2003	-58.6116	-80.7358	-105.6266	-97.2978	-96.5324	-84.3402	-58.0703	-28.7085	-0.0000	-0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h	281.8573	232.9038	204.1068	143.3328	104.4158	89.8835	86.8225	108.2621	144.0589	202.5309	248.8778	278.5844 (64)	
Electric shower(s)												2125.6365 (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	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													
115.6273	102.6166	108.6111	92.5485	85.7675	77.5471	76.7852	80.2949	85.8851	98.1443	103.9549	114.5391	(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	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	35.2167	31.2791	25.4379	19.2581	14.3957	12.1534	13.1322	17.0698	22.9110	29.0908	33.9532	36.1955 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	442.8980	447.4939	435.9124	411.2567	380.1334	350.8818	331.3400	326.7441	338.3256	362.9812	394.1046	423.3561 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500 (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)												
	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144 (71)
Water heating gains (Table 5)												
	155.4130	152.7032	145.9827	128.5395	115.2789	107.7044	103.2059	107.9233	119.2848	131.9144	144.3817	153.9504 (72)
Total internal gains												
	746.6349	744.5835	720.4402	672.1616	622.9152	583.8468	560.7853	564.8444	593.6286	637.0936	685.5468	726.6092 (73)

6. Solar gains

[Jan]												
				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
Southeast				13.4600	36.7938		0.6000		0.7000		0.7700	144.1460 (77)
Northwest				12.1100	11.2829		0.6000		0.7000		0.7700	39.7694 (81)
Solar gains	183.9154	326.4857	481.7996	655.7852	788.2150	806.1275	767.3665	664.9580	541.4828	370.2968	222.6939	155.8366 (83)
Total gains	930.5503	1071.0692	1202.2398	1327.9468	1411.1302	1389.9744	1328.1518	1229.8024	1135.1114	1007.3905	908.2406	882.4458 (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	33.7561	33.8764	33.9976	34.6170	34.7436	35.3907	35.3907	35.5230	35.1290	34.7436	34.4913	34.2427
alpha	3.2504	3.2584	3.2665	3.3078	3.3162	3.3594	3.3594	3.3682	3.3419	3.3162	3.2994	3.2828
util living area	0.9263	0.8893	0.8265	0.7169	0.5749	0.4198	0.3088	0.3454	0.5356	0.7660	0.8915	0.9352 (86)
Living	19.4855	19.7815	20.1709	20.5816	20.8376	20.9584	20.9887	20.9836	20.9051	20.5573	19.9646	19.4345
Non living	18.8891	19.1778	19.5531	19.9464	20.1759	20.2858	20.3072	20.3066	20.2424	19.9346	19.3696	18.8467
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2252	19.7815	20.1709	20.5816	20.8376	20.9584	20.9887	20.9836	20.9051	20.5573	19.9646	19.6535 (87)
Th 2	20.2820	20.2843	20.2867	20.2986	20.3010	20.3130	20.3130	20.3154	20.3082	20.3010	20.2962	20.2915 (88)
util rest of house	0.9182	0.8780	0.8096	0.6917	0.5408	0.3784	0.2620	0.2962	0.4908	0.7385	0.8786	0.9280 (89)
MIT 2	19.5694	19.1778	19.5531	19.9464	20.1759	20.2858	20.3072	20.3066	20.2424	19.9346	19.3696	19.0488 (90)
Living area fraction									fLA = Living area / (4) =			0.1221 (91)
MIT	19.6495	19.2515	19.6285	20.0239	20.2566	20.3679	20.3904	20.3893	20.3233	20.0106	19.4422	19.1226 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6495	19.2515	19.6285	20.0239	20.2566	20.3679	20.3904	20.3893	20.3233	20.0106	19.4422	19.1226 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9103	0.8592	0.7923	0.6812	0.5386	0.3818	0.2673	0.3015	0.4918	0.7261	0.8604	0.9140 (94)
Useful gains	847.0758	920.2556	952.5726	904.6454	760.0473	530.6624	355.0582	370.8360	558.3035	731.4316	781.4283	806.5840 (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	1521.1160	1417.1640	1291.7772	1074.9500	823.8523	545.1919	358.2759	375.6690	592.6163	906.0745	1197.0251	1457.7978 (97)
Space heating kWh	501.4859	333.9224	252.3683	122.6193	47.4709	0.0000	0.0000	0.0000	0.0000	129.9343	299.2297	484.5031 (98a)
Space heating requirement - total per year (kWh/year)												2171.5340
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	501.4859	333.9224	252.3683	122.6193	47.4709	0.0000	0.0000	0.0000	0.0000	129.9343	299.2297	484.5031 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2171.5340
Space heating per m2										(98c) / (4) =		16.8088 (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 %)												249.2796 (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	501.4859	333.9224	252.3683	122.6193	47.4709	0.0000	0.0000	0.0000	0.0000	129.9343	299.2297	484.5031 (98)
Space heating efficiency (main heating system 1)	249.2796	249.2796	249.2796	249.2796	249.2796	0.0000	0.0000	0.0000	0.0000	249.2796	249.2796	249.2796 (210)
Space heating fuel (main heating system)	201.1741	133.9550	101.2390	49.1895	19.0432	0.0000	0.0000	0.0000	0.0000	52.1239	120.0378	194.3613 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	281.8573	232.9038	204.1068	143.3328	104.4158	89.8835	86.8225	108.2621	144.0589	202.5309	248.8778	278.5844 (64)
Efficiency of water heater (217)m	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600 (216)
Fuel for water heating, kWh/month	166.2286	137.3578	120.3744	84.5322	61.5805	53.0099	51.2046	63.8488	84.9604	119.4450	146.7786	164.2984 (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	44.5120	40.2044	44.5120	43.0761	44.5120	43.0761	44.5120	44.5120	43.0761	44.5120	43.0761	44.5120 (231)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-48.4141	-73.0931	-112.6518	-132.9134	-144.9583	-134.6788	-132.3146	-122.9146	-105.5476	-84.9967	-54.3389	-41.1348 (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	-15.9723	-37.5246	-86.4673	-153.1720	-227.9182	-240.5899	-234.2778	-183.8608	-119.4154	-59.1006	-22.6057	-12.3885 (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												871.1237 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.5600
Water heating fuel used												1253.6190 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)	
mechanical ventilation fans (SFP = 1.0875)	444.0924 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	524.0924 (231)
Electricity for lighting (calculated in Appendix L)	248.7750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2581.2496 (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	316.3606 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	871.1237	16.4900	143.6483 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1253.6190	16.4900	206.7218 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	444.0924	16.4900	73.2308 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	248.7750	16.4900	41.0230 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1187.9567	16.4900	-195.8941
PV Unit electricity exported	-1393.2929	5.5900	-77.8851
Total			-273.7791 (252)
Total energy cost			204.0368 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4217 (257)
SAP value		93.1645
SAP rating (Section 12)		93 (258)
SAP band		A

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	871.1237	0.1563	136.1570 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1253.6190	0.1455	182.4564 (264)
Space and water heating			318.6133 (265)
Pumps, fans and electric keep-hot	524.0924	0.1387	72.6981 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1187.9567	0.1338	-158.9245
PV Unit electricity exported	-1393.2929	0.1220	-169.9364
Total			-328.8609 (269)
Total CO2, kg/year			98.3564 (272)
CO2 emissions per m2			0.7600 (273)
EI value			99.2434
EI rating			99 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	46.9700 (1b)	x 2.4000 (2b)	= 112.7280 (1b) - (3b)
First floor	49.3400 (1c)	x 2.7000 (2c)	= 133.2180 (1c) - (3c)
Second floor	32.8800 (1d)	x 2.7000 (2d)	= 88.7760 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	334.7220 (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)

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Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 0 * 10 = 0.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 3.0000 (17)
Infiltration rate 0.1500 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.2000	5.2000	5.0000	4.4000	4.3000	3.9000	3.7000	3.7000	4.1000	4.6000	4.8000	4.7000 (22)
Wind factor	1.3000	1.3000	1.2500	1.1000	1.0750	0.9750	0.9250	0.9250	1.0250	1.1500	1.2000	1.1750 (22a)
Adj infilt rate	0.1658	0.1658	0.1594	0.1403	0.1371	0.1243	0.1179	0.1179	0.1307	0.1466	0.1530	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												71.1000 (23c)
Effective ac	0.3102	0.3102	0.3039	0.2847	0.2816	0.2688	0.2624	0.2624	0.2752	0.2911	0.2975	0.2943 (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					
Main dwelling												
Windows / Glazed Doors			25.5700	1.1450	29.2786		(27)					
Door			2.9300	1.2000	3.5160		(26)					
Ground Floor			46.9700	0.1200	5.6364	110.0000	5166.7000 (28a)					
Exposed Floor			2.3700	0.1200	0.2844	20.0000	47.4000 (28b)					
GF	32.3200	11.5800	20.7400	0.1500	3.1110	18.0000	373.3200 (29a)					
FF	26.6400	8.4900	18.1500	0.1500	2.7225	18.0000	326.7000 (29a)					
SF	26.1100	8.4300	17.6800	0.1500	2.6520	18.0000	318.2400 (29a)					
Main Roof	32.8800		32.8800	0.1100	3.6168	9.0000	295.9200 (30)					
Balcony Roof	14.7400		14.7400	0.1100	1.6214	9.0000	132.6600 (30)					
Total net area of external elements Aum(A, m2)			182.0300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.4391		(33)					
Main dwelling												
Party Wall 1			55.9800	0.0000	0.0000	20.0000	1119.6000 (32)					
GF - Internal Wall 1			84.5100			9.0000	760.5900 (32c)					
FF - Internal Wall 2			94.5800			9.0000	851.2200 (32c)					
SF Internal Wall 3			54.9300			9.0000	494.3700 (32c)					
Internal Floor 1			46.9700			18.0000	845.4600 (32d)					
Internal Floor 2			32.8800			18.0000	591.8400 (32d)					
Internal Ceiling 1			46.9700			9.0000	422.7300 (32e)					
Internal Ceiling 2			32.8800			9.0000	295.9200 (32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 12042.6700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							93.2167 (35)					
Thermal bridges (User defined value 0.070 * total exposed area)							12.7421 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	65.1812 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.2697	Feb 34.2697	Mar 33.5655	Apr 31.4530	May 31.1009	Jun 29.6926	Jul 28.9884	Aug 28.9884	Sep 30.3967	Oct 32.1572	Nov 32.8613	Dec 32.5092 (38)
Heat transfer coeff	99.4509	99.4509	98.7467	96.6342	96.2821	94.8738	94.1696	94.1696	95.5780	97.3384	98.0426	97.6905 (39)
Average = Sum(39)m / 12 =												96.8689
HLP	Jan 0.7698	Feb 0.7698	Mar 0.7644	Apr 0.7480	May 0.7453	Jun 0.7344	Jul 0.7289	Aug 0.7289	Sep 0.7398	Oct 0.7535	Nov 0.7589	Dec 0.7562 (40)
HLP (average)												0.7498
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8929 (42)
Hot water usage for mixer showers													
72.7236	71.6307	70.0381	66.9910	64.7424	62.2347	60.8093	62.3898	64.1224	66.8149	69.9274	72.4449	72.4449 (42a)	
Hot water usage for baths													
31.3967	30.9305	30.2738	29.0631	28.1566	27.1513	26.6084	27.2604	27.9703	29.0460	30.2816	31.2906	31.2906 (42b)	
Hot water usage for other uses													
44.2558	42.6465	41.0372	39.4279	37.8186	36.2093	36.2093	37.8186	39.4279	41.0372	42.6465	44.2558	44.2558 (42c)	
Average daily hot water use (litres/day)													136.3909 (43)
Daily hot water use	Jan 148.3761	Feb 145.2076	Mar 141.3491	Apr 135.4820	May 130.7175	Jun 125.5953	Jul 123.6269	Aug 127.4688	Sep 131.5206	Oct 136.8980	Nov 142.8555	Dec 147.9913 (44)	
Energy conte	234.9915	206.7737	217.2483	185.4681	175.9709	154.4341	149.5161	157.8330	162.1780	185.7693	203.5238	231.7186 (45)	
Energy content (annual)													Total = Sum(45)m = 2265.4253
Distribution loss (46)m = 0.15 x (45)m													
35.2487	31.0161	32.5872	27.8202	26.3956	23.1651	22.4274	23.6749	24.3267	27.8654	30.5286	34.7578	34.7578 (46)	
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7614 (55)
Total storage loss	23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034 (56)
If cylinder contains dedicated solar storage													
23.6034	21.3192	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034	22.8420	23.6034	22.8420	23.6034	23.6034 (57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month	281.8573	249.1041	262.7184	224.0685	210.0424	187.1813	183.3549	192.6023	202.1291	231.2393	248.8778	278.5844 (62)	

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WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												626.1042 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												626.1042
Solar input	-0.0000	-13.2279	-57.6950	-85.6679	-110.2962	-98.0444	-98.2385	-82.7168	-56.0520	-24.1656	-0.0000	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	281.8573	235.8762	205.0234	138.4007	99.7461	89.1370	85.1164	109.8855	146.0772	207.0738	248.8778	278.5844 (64)
	Total per year (kWh/year) = Sum(64)m =											2125.6557 (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	115.6273	102.6166	108.6111	92.5485	85.7675	77.5471	76.7852	80.2949	85.8851	98.1443	103.9549	114.5391 (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	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	173.5716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.2167	31.2791	25.4379	19.2581	14.3957	12.1534	13.1322	17.0698	22.9110	29.0908	33.9532	36.1955	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.8980	447.4939	435.9124	411.2567	380.1334	350.8818	331.3400	326.7441	338.3256	362.9812	394.1046	423.3561	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	55.2500	(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)	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	-115.7144	(71)
Water heating gains (Table 5)	155.4130	152.7032	145.9827	128.5395	115.2789	107.7044	103.2059	107.9233	119.2848	131.9144	144.3817	153.9504	(72)
Total internal gains	746.6349	744.5835	720.4402	672.1616	622.9152	583.8468	560.7853	564.8444	593.6286	637.0936	685.5468	726.6092	(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
Southeast					13.4600	33.4622	0.6000		0.7000	0.7700		131.0939 (77)
Northwest					12.1100	10.0309	0.6000		0.7000	0.7700		35.3564 (81)
Solar gains	166.4502	314.8761	484.6726	693.4663	825.8407	821.5581	791.4583	666.1800	539.5600	354.7044	207.0361	144.2956 (83)
Total gains	913.0851	1059.4595	1205.1128	1365.6279	1448.7558	1405.4050	1352.2436	1231.0243	1133.1886	991.7980	892.5828	870.9048 (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	33.6366	33.6366	33.8764	34.6170	34.7436	35.2593	35.5230	35.5230	34.9996	34.3666	34.1197	34.2427
alpha	3.2424	3.2424	3.2584	3.3078	3.3162	3.3506	3.3682	3.3682	3.3333	3.2911	3.2746	3.2828
util living area	0.9336	0.9010	0.8453	0.7380	0.6082	0.4956	0.4108	0.4533	0.6134	0.8050	0.9046	0.9416 (86)
Living	19.3821	19.6528	20.0401	20.5030	20.7869	20.9157	20.9633	20.9498	20.8287	20.4208	19.8418	19.3309
Non living	18.7858	19.0487	19.4254	19.8727	20.1313	20.2500	20.2919	20.2828	20.1773	19.8023	19.2450	18.7445
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1723	19.6528	20.0401	20.5030	20.7869	20.9157	20.9633	20.9498	20.8287	20.4208	19.8418	19.5643 (87)
Th 2	20.2796	20.2796	20.2843	20.2986	20.3010	20.3106	20.3154	20.3154	20.3058	20.2939	20.2891	20.2915 (88)
util rest of house	0.9264	0.8910	0.8305	0.7154	0.5773	0.4578	0.3682	0.4083	0.5744	0.7817	0.8932	0.9353 (89)
MIT 2	19.5154	19.0487	19.4254	19.8727	20.1313	20.2500	20.2919	20.2828	20.1773	19.8023	19.2450	18.9609 (90)
Living area fraction	19.5956	19.1224	19.5004	19.9497	20.2113	20.3313	20.3739	20.3642	fLA = Living area / (4) =			0.1221 (91)
MIT	19.5956	19.1224	19.5004	19.9497	20.2113	20.3313	20.3739	20.3642	20.2568	19.8778	19.3179	19.0346 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5956	19.1224	19.5004	19.9497	20.2113	20.3313	20.3739	20.3642	20.2568	19.8778	19.3179	19.0346 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9187	0.8721	0.8123	0.7034	0.5732	0.4589	0.3719	0.4115	0.5715	0.7665	0.8750	0.9218	(94)
Useful gains	838.8457	923.9654	978.9343	960.5568	830.3765	644.9627	502.8994	506.6150	647.6074	760.2431	780.9689	802.7793	(95)
Ext temp.	3.9000	4.3000	5.6000	7.9000	10.7000	13.2000	14.9000	14.8000	12.8000	9.7000	6.6000	3.7000	(96)
Heat loss rate W													
	1560.9431	1474.1051	1372.6231	1164.4101	915.7691	676.5705	515.4732	523.9761	712.7056	990.6880	1246.8937	1498.0429	(97)
Space heating kWh													
	537.2405	369.6939	292.9045	146.7743	63.5321	0.0000	0.0000	0.0000	0.0000	171.4510	335.4659	517.2761	(98a)
Space heating requirement - total per year (kWh/year)													2434.3384
Solar heating kWh													

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-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh												
537.2405	369.6939	292.9045	146.7743	63.5321	0.0000	0.0000	0.0000	0.0000	171.4510	335.4659	517.2761	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2434.3384
Space heating per m2												(98c) / (4) = 18.8431 (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 %)												249.1877 (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	537.2405	369.6939	292.9045	146.7743	63.5321	0.0000	0.0000	0.0000	0.0000	171.4510	335.4659	517.2761 (98)
Space heating efficiency (main heating system 1)	249.1877	249.1877	249.1877	249.1877	249.1877	0.0000	0.0000	0.0000	0.0000	249.1877	249.1877	249.1877 (210)
Space heating fuel (main heating system)	215.5967	148.3596	117.5437	58.9011	25.4957	0.0000	0.0000	0.0000	0.0000	68.8040	134.6238	207.5849 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	281.8573	235.8762	205.0234	138.4007	99.7461	89.1370	85.1164	109.8855	146.0772	207.0738	248.8778	278.5844 (64)
Efficiency of water heater	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600	169.5600 (216)
Fuel for water heating, kWh/month	166.2286	139.1108	120.9150	81.6234	58.8265	52.5696	50.1984	64.8063	86.1507	122.1242	146.7786	164.2984 (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	44.5120	40.2044	44.5120	43.0761	44.5120	43.0761	44.5120	44.5120	43.0761	44.5120	43.0761	44.5120 (231)
Lighting	30.8249	24.7289	22.2656	16.3128	12.6005	10.2947	11.4946	14.9411	19.4070	25.4630	28.7604	31.6817 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-44.1998	-70.8352	-113.2394	-137.6115	-148.7003	-135.5603	-133.8063	-122.7721	-104.8787	-82.5292	-50.9594	-38.2625 (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	-13.5377	-34.8064	-85.2077	-162.7613	-240.0597	-245.4006	-242.6573	-182.6728	-117.3647	-54.1493	-19.9017	-10.8564 (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												976.9095 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												169.5600
Water heating fuel used												1253.6304 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0875)												
mechanical ventilation fans (SFP = 1.0875)												444.0924 (230a)
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												524.0924 (231)
Electricity for lighting (calculated in Appendix L)												248.7750 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2592.7302 (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												410.6772 (238)

10a. Fuel costs - using BEDF prices (585)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	976.9095	28.4300	277.7354 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1253.6304	28.4300	356.4071 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	444.0924	28.4300	126.2555 (249)
Pump for solar water heating	80.0000	28.4300	22.7440 (249)
Energy for lighting	248.7750	28.4300	70.7267 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1183.3547	28.4300	-336.4277
PV Unit electricity exported	-1409.3756	5.8100	-81.8847
Total			-418.3124 (252)
Total energy cost			435.5563 (255)

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	976.9095	0.1558	152.1742 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1253.6304	0.1456	182.4924 (264)
Space and water heating			334.6665 (265)
Pumps, fans and electric keep-hot	524.0924	0.1387	72.6981 (267)
Energy for lighting	248.7750	0.1443	35.9059 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1183.3547	0.1335	-157.9917
PV Unit electricity exported	-1409.3756	0.1215	-171.2585
Total			-329.2502 (269)
Total CO2, kg/year			114.0203 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	976.9095	1.5767	1540.2534 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1253.6304	1.5385	1928.6818 (278)
Space and water heating			3468.9352 (279)
Pumps, fans and electric keep-hot	524.0924	1.5128	792.8470 (281)
Energy for lighting	248.7750	1.5338	381.5794 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1183.3547	1.4934	-1767.2180
PV Unit electricity exported	-1409.3756	0.4458	-628.3534
Total			-2395.5714 (283)
Total Primary energy kWh/year			2247.7902 (286)

Appendix – Energy Use Intensity Analysis

Energy Use Intensity Calculation: Apartments						
	Heating	Hot Water	Lighting	Auxiliary	Appliances	Total
	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>
January	4,179.30	1,786.25	556.36	459.02	3,270.90	10,251.88
February	1,832.10	1,568.80	349.64	529.89	2,954.30	7,234.73
March	646.40	1,634.38	407.26	586.66	3,270.90	6,545.60
April	241.80	1,205.66	563.94	567.74	3,165.40	5,744.54
May	311.30	1,170.45	616.71	586.66	3,270.90	5,956.03
June	0.00	1,029.96	437.15	567.74	3,165.40	5,200.24
July	0.00	974.05	366.84	586.66	3,270.90	5,198.46
August	0.00	1,089.67	505.65	586.66	3,270.90	5,452.88
September	21.40	1,094.27	612.92	567.74	3,165.40	5,461.73
October	381.90	1,501.14	533.94	586.66	3,270.90	6,274.54
November	1,023.00	1,610.34	363.45	567.74	3,165.40	6,729.93
December	2,674.30	1,737.10	426.12	586.66	3,270.90	8,695.08
Total	11,311.50	16,402.09	5,739.96	6,779.85	38,512.20	78,745.65

Energy Use Intensity Calculation: Apartments						
	Heating	Hot Water	Lighting	Auxiliary	Appliances	Total
	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>
Total	9.81	14.22	4.98	5.88	33.39	68.27

Energy Use Intensity Calculation: Photovoltaic Potential (Apartments)				
	kWp	m ²	kWh/pa	<i>kWh/m²</i>
PV	59	280.25	39,659.82	34.38

Energy Use Intensity Calculation: Houses						
	Heating	Hot Water	Lighting	Auxiliary	Appliances	Total
	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>
January	2,290.29	874.17	199.31	199.31	1,332.50	4,895.59
February	1,373.21	765.81	180.03	197.78	1,203.60	3,720.43
March	767.97	793.21	199.31	218.97	1,332.50	3,311.97
April	460.34	516.72	192.88	211.91	1,289.60	2,671.46
May	313.08	498.12	199.31	218.97	1,332.50	2,561.99
June	0.00	433.24	192.88	211.91	1,289.60	2,127.63
July	0.00	404.81	199.31	218.97	1,332.50	2,155.60
August	0.00	459.74	199.31	218.97	1,332.50	2,210.53
September	167.24	463.80	192.88	211.91	1,289.60	2,325.43
October	532.39	722.18	199.31	218.97	1,332.50	3,005.35
November	796.79	782.91	192.88	211.91	1,289.60	3,274.09
December	1,535.25	847.97	199.31	218.97	1,332.50	4,134.00
Total	8,236.56	7,562.69	2,346.76	2,558.56	15,689.50	36,394.07

Energy Use Intensity Calculation: Houses						
	Heating	Hot Water	Lighting	Auxiliary	Appliances	Total
	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>
Total	12.75	11.71	3.63	3.96	24.29	56.34

Energy Use Intensity Calculation: Photovoltaic Potential (Houses)				
	kWp	m ²	kWh/pa	<i>kWh/m²</i>
PV	24	114	12,906.25	19.98

Energy Use Intensity Calculation: Communal Area (Apartments)						
	Heating	Hot Water	Lighting	Auxiliary*	Appliances	Total
	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>	<i>kWh</i>
January	857.5	0	371.7	310.78	0	1,539.98
February	532.6	0	333.8	280.70	0	1,147.10
March	392.9	0	366.9	310.78	0	1,070.58
April	289.4	0	359.1	300.75	0	949.25
May	67.2	0	369.3	310.78	0	747.28
June	0	0	356.7	300.75	0	657.45
July	0	0	371.7	310.78	0	682.48
August	0	0	366.9	310.78	0	677.68
September	0	0	359.1	300.75	0	659.85
October	145.8	0	371.7	310.78	0	828.28
November	428.6	0	354.2	300.75	0	1,083.55
December	676.4	0	371.7	310.78	0	1,358.88
Total	3,390.4	0	4,352.6	3,659.13	0	11,402.13

*Auxiliary equipment loads include lift usage and cold-water pump sets

Energy Use Intensity Calculation: Communal Area (Apartment)						
	Heating	Hot Water	Lighting	Auxiliary	Appliances	Total
	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>	<i>kWh/m²</i>
Total	10.43	0	13.39	11.26	0	35.07

Energy Use Intensity Calculation: Photovoltaic Potential (Communal Area, Apartments)				
	kWp	m ²	kWh/pa	<i>kWh/m²</i>
PV	9	42.8	6,297.19	19.37

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Residential areas

		<i>Ref. name</i>	Apartments	Town Houses
		<i>No. dwellings</i>	23	5
		<i>Area (m² GIA)</i>	1,153.51	645.95
		Target values	Building 1	Building 2
Minimise energy demand	Space heating demand (kWh/m² GIA/yr)	≤ 15 (flats) ≤ 20 (houses)	9.81	12.75
	Calculation methodology used to calculate space heating demand and confirmation that this covers all homes/blocks	<i>Predictive energy model</i>	DSM TM54	DSM TM54
	Form factor per building	≤ 2	1.19	1.85
	Average external wall U-value (W/m ² K)	≤ 0.15	0.15	0.15
	Average window U-value (W/m ² K)	≤ 1 (triple)	1.2	1.2
	Air permeability rate (m ³ /h/m ² @ 50 Pa)	≤ 1	3	3
Maximise energy efficiency	Energy use intensity (kWh/m² GIA/yr)	≤ 35	68.27	56.34
	Calculation methodology used to calculate energy use intensity and confirmation that this covers all homes/blocks	<i>Predictive energy model</i>	DSM / TM54	DSM / TM54
Use renewable energy	PV footprint area (% of ground floor space)	≥ 40	87%	48%
	Annual renewable energy generation (kWh/m ² building footprint/yr)	-	34.38	19.98
	Renewable energy balance (%)	-	50%	35%
	Total energy used (kWh/yr)	-	78,745.65	36,394.07
	Total energy generated on-site (kWh/yr)	-	39,659.82	12,906.25
Use low carbon energy	Fossil fuel free (yes/no)	Yes	Yes	Yes
	Heat source	<i>Electric</i>	Electric Panel	Electric ASHP
	Low Carbon Heat Appraisal completed	Yes	Yes	Yes
	Heat network suitability	-	-	-
	Exemption requested	-	-	-
	Efficiency of heating system (SCOP)	≥ 3.5	1	3.77
	Carbon content of heat (gCO ₂ /kWh)	≤ 100	<100	<100
Reduce overheating risk	Have Part O overheating requirements been met without the use of mechanical cooling?	Yes	Yes	Yes
	If no, how many homes are cooled?	Yes	-	-
	Has a CIBSE TM59 assessment been carried out using DSY2 and DSY3 weather files? Have any additional passive measures been included as a result?	Yes	DSY1 2020 High	DSY 2020 High

Energy & Carbon Proforma

Communal areas

		Ref. name	Communal Areas	
		No. dwellings	n/a	
		Area (m ² GIA)	325.1	
		Target values	Building 1	
Minimise energy demand	Space heating demand (kWh/m ² GIA/yr)	≤ 15	10.43	
	Space cooling demand (kWh/m ² GIA/yr)	≤ 15	0	
	Calculation methodology used to calculate space heating demand and confirmation that this covers all homes/blocks	Predictive energy model	DSM TM54	
	Form factor per building	≤ 2	1.25	
	Average external wall U-value (W/m ² K)	≤ 0.15	0.15	
	Average window U-value (W/m ² K)	≤ 1 (triple)	1.2	
Maximise energy efficiency	BREEAM (Ene 01 rating)	Excellent	Excellent	
	Energy use intensity (kWh/m ² GIA/yr)	-	35.07	
	Calculation methodology used to calculate energy use intensity and confirmation that this covers all homes/blocks	Predictive energy model	DSM / TM54	
Use renewable energy	PV footprint area (% of ground floor space)	-	28%	
	Annual renewable energy generation (kWh/m ² building footprint/yr)	-	19.37	
	Renewable energy balance (%)	-	55.2%	
	Total energy used (kWh/yr)	-	11,402.13	
	Total energy generated on-site (kWh/yr)	-	6,297.19	
Use low carbon energy	Fossil fuel free (yes/no)	Yes	Yes	
	Heat source - Where the system for generating space heating and hot water is a heat pump and it achieves a SCOP of 3.5 or higher (then a Low Carbon Heat Appraisal not required)	Electric	Electric Panel	
Reduce overheating risk	Has CIBSE TM52 been used to calculate overheating and does the building pass?	Yes	No	
	What percentage of spaces are cooled? (% of GIA)	-	0%	