WHITECODE
CONSULTING

Energy & Sustainability Strategy

Residential scheme

Courthouse Farm Copthorne

Prepared for Option Two Development Ltd.

12647-WCL-ZZ-ZZ-RP-Y-0001

Rev 01

October 2025

Executive Summary

This energy and sustainability strategy has been prepared by Whitecode Consulting to accompany an application for outline planning permission for the development at Courthouse Farm, Copthorne. The planning application is submitted on behalf of Option Two Development Ltd.

It is completed in line with energy requirements for the site and the Mid Sussex District Plan, adopted March 2018, which set out long term energy and sustainability related standards for the area. The site description is as follows:

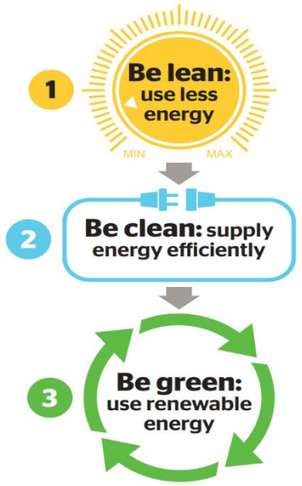
"Outline planning application for the erection of around 86 dwellings (Use Class C3), including associated parking, outdoor amenity space, landscaping and drainage, and other associated works, with all matters reserved except for the new access proposed from Copthorne Common Road."

The new build residential dwellings have been assessed against Part L1A 2021 of the Building Regulations using the Standard Assessment Procedure (SAP) 10.2 methodology. The strategy outlines the proposed energy strategy for the site following the energy hierarchy Be Lean – Be Clean – Be Green

Energy efficiency is the first stage of the energy hierarchy. Energy demand should be reduced as far as possible before the heating strategy and installation of low-carbon and renewable technologies is considered. This is important in protecting consumers from high prices.

This report concludes that the proposed **site-wide** development will achieve a 79% improvement over Part L 2021 of the Building Regulations.

Although Mid Sussex District Plan does not require a specific carbon reduction, the scheme has been designed to use highly efficient Air Source Heat Pumps (ASHPs) and Photovoltaic (PV) panels to fall in line with the Future Homes Standard in 2026.



- **Be Lean** – improved building fabric specification to exceed that of the notional building, low air permeability target, thermal bridging details and selection of energy efficient services.

- **Be Clean** – connection to a district heat network and installation of Combined Heat and Power (CHP) have been investigated for the site and not been deemed either available or appropriate at this time.

- **Be Green** – Houses will be heated with ASHPs and apartments will have Electric Panels with heat pump hot water cylinders. There will be photovoltaic (PV) panels provided to each house type and apartments.

This report concludes that the proposed development will achieve a **79% improvement** over Part L 2021 of the Building Regulations.

The following table demonstrates the overall reduction in regulated carbon emissions of the development after each stage of the energy hierarchy.

	Carbon dioxide emissions (tonnes CO_2 per annum)
	Site wide
Baseline: Part L 2021 of the Building Regulations compliant development	91.4
After fabric efficiency (Be Lean)	81.2
After renewable energy (Be Green)	19.3
% carbon reduction	79%

Table 1: Site-wide carbon savings

The scheme meets the sustainability requirements of the Mid Sussex District Plan for air quality, noise pollution, water use, flood risk, waste reduction, transport and ecology.

Contents

Revisions:

Rev No:	Date:	Status/Comments:	Prepared by:	Checked by:
P01	29/10/25	First Issue	SR	EH

1. Introduction

The purpose of this report is to show how the client can address the relevant energy conditions for the proposed development located at Courthouse Farm, Copthorne. These conditions are highlighted below.

1.1. National Planning Policy and Targets

The proposed development will be constructed to be compliant with Part L 2021 of the Building Regulations. The proposed development consists of new build dwellings, under Part L1A 2021 of the Building Regulations. They mandate that the design of the building demonstrably causes lower carbon dioxide (CO_2) emissions than a notional equivalent of given specifications.

The National Planning Policy Framework (NPPF) was updated in February 2025, which re-emphasises the Government's commitment to sustainable development and states the need for planning authorities to take an approach based on integrating the four aims of sustainable development. The document also refers to the Government's energy policies and objectives. It sets out key principles that regional planning bodies and local planning authorities should adhere to in their approach to planning for renewable energy.

Energy use should be prioritised in line with the Energy Hierarchy. The first priority is to be lean. This is to ensure less overall energy use with good building design and high energy efficiency using passive design measures, such as building orientation, internal and external building layout, tree planting (prioritising endemic and deciduous species) and the size and location of windows.

The second priority is to be clean; to use energy that is supplied efficiently. Developments should consider connecting to decentralised energy networks (energy generated off the energy grid). This can include technologies such as solar energy and water, heat pumps, biomass-fuelled energy generation and larger-scale schemes, such as Combined Heat and Power (CHP) systems.

The final priority is to be green and use renewable low or zero carbon energy sources. To reduce the impact on the environment and contribute towards the borough becoming carbon neutral, energy generation using sustainable sources is strongly encouraged.

1.2. Local Planning Policies

The proposed development lies in Mid Sussex; therefore, the applicable District Planning Policy is the Mid Sussex District Plan, adopted 2018.

The planning policies of relevance to energy and sustainability in the Local Plan are as follows:

- Policy DP39: Sustainable Design and Construction
- Policy DP40: Renewable Energy Schemes
- Policy DP41: Flood Risk and Drainage
- Policy DP42: Water Infrastructure and the Water Environment

1.3 The Development

The Development is for the construction of 78 houses and 8 apartment units. The dwellings have been modelled using the Standard Assessment Procedure (SAP) 10.2 methodology.

Figure 1.1 Proposed Site Plan

The site consists of:

- 8 Apartments
- 15 2B4P houses
- 35 3B5P houses
- 21 3B6P houses
- 7 4B8P houses

2 Baseline Energy Consumption & Carbon Emissions

An assessment of the site's potential energy use was conducted in compliance with the minimum requirements of Part L1A 2021 of the Building Regulations.

The energy assessment must first establish the regulated CO_2 emissions baseline assuming the development complied with Part L 2021 of the Building Regulations using Building Regulations approved compliance software.

Regulated energy is calculated as follows:

Dwellings: Dwelling CO_2 Emissions Rates (DER) have been calculated through Part L 2021 of the Building Regulations methodology SAP 10.2. A representative sample of dwellings has been selected to model covering all unit types, orientations and floor levels.

To determine the CO_2 emissions baseline, the Target Emission Rate (TER) from the Be Lean model is used.

Regulated carbon dioxide emissions (tonnes CO_2 per annum)	Site wide
Baseline: Part L 2021 of the Building Regulations compliant development	91.4

Table 2.1 *Baseline carbon emissions*

Approved Document L1A also includes the fabric energy efficiency (FEE) which is a measure of the amount of energy which would normally be needed to maintain comfortable internal temperatures and can be influenced by fabric U-values, thermal bridging, air permeability and thermal mass.

Fabric Energy Efficiency	kWh/m²
Part L1A Target Fabric Energy Efficiency Rate (TFEE)	38.51

Table 2.2 *Target fabric energy efficiency*

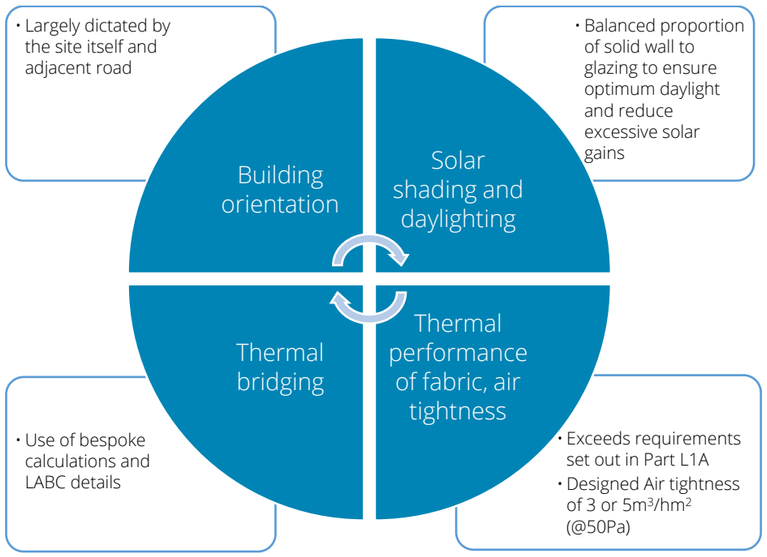
3 ‘Be Lean’ – Energy Efficient Design

An assessment of the site's potential energy use was conducted in compliance with the minimum requirements of Part L1 2021 of the Building Regulations.

Local planning guidelines require a reduction in the CO_2 emissions of the proposed scheme by energy-efficient measures. A number of energy-efficient measures are considered below.

3.1 Passive Design Measures

Passive design measures involve adapting building massing, layout and glazing to best respond to the local climate and annual sun path in order to reduce energy demands.



The table below shows the proposed building fabric against Part L of the Building Regulations. Approximately 50% of heat is lost through the fabric of a building. This includes walls, floors, windows, roofs and the thermal bridging connecting them. The remaining 50% is lost through uncontrolled ventilation through gaps around doors, windows, and any service penetrations.

Element:	Part L 2021 Limiting Values:	Domestic design
Floors	0.25 W/m²K	0.12 W/m²K
External Walls	0.30 W/m²K	0.15 W/m²K
Roof	0.20 W/m²K	0.12 W/m²K
Front Doors	2.00 W/m²K	1.30 W/m²K
Windows	2.00 W/m²K	1.20 W/m²K
Window g-value	N/A	0.63
Air Permeability Rate	10m³/hm² (@50Pa)	House: 5 m³/hm² (@50Pa) Apartments: 3 m³/hm² (@50Pa)

Table 3.1 Proposed U-values

A thermal bridge, also called a cold bridge, is an area of a building construction which has a significantly higher heat transfer than the surrounding materials. This is typically where there is either a break in the insulation, less insulation or the insulation is penetrated by an element with a higher thermal conductivity. Where the building is situated in a cold climate (such as the UK) this can result in additional heat loss at these points.

Around 30% of the total heat loss through a building’s fabric can be caused by thermal bridging. Indications are that better detailing and improved air tightness can reduce a dwelling’s annual CO2 emissions by up to 10%.

This development will use a range of default construction details as well as bespoke calculations for the psi values.

3.2 Active design measures

After addressing the passive design measures the next step is to use energy efficient building services, lighting, and controls throughout the scheme to reduce fuel consumption.

Space heating and hot water

- Apartments: Electric panels heaters and heat pump hot water cylinders
- Houses: Monobloc ASHP

Ventilation

- The apartments will be provided with mechanical ventilation with heat recovery (MVHR)
- The houses will have natural ventilation with intermittent extract fans

Building services insulation

- All building services, tanks, pipes and ducts will be insulated to a high standard.

Lighting

- Internal lighting has a significant impact on the Dwelling Emission Rate (DER). Therefore, it is recommended that 100% of all internal light fittings will be low energy in order to reduce CO_2 emissions and the overall energy used (typical tungsten bulbs can use up to 300% more energy).
- Lighting in residential has assumed to be LED / CFL (Lm/W = 100)

3.3 Be Lean results

There has been a 11% reduction at Be Lean stage due fabric first approach including low U-values, air permeability and thermal bridging.

Regulated carbon dioxide emissions (tonnes of CO_2 per annum)	**Site wide tonnes CO_2 per annum**
Baseline: Part L 2021 of the Building Regulations compliant development	91.4
After energy demand reduction (be lean)	81.2
Carbon savings over baseline	10.2
Carbon reduction over baseline	11%

***Table 3.2**: Be Lean results*

The reduction in fabric energy efficiency is 16% as the following table demonstrates:

Fabric energy efficiency	**(kWh/m² per annum)**
Part L1A Target Fabric Energy Efficiency Rate (TFEE)	38.51
Dwelling Fabric Efficiency (DFEE)	32.47
Reduction over TFEE	16%

***Table 3.3**: Fabric energy efficiency*

4 Cooling Due to Potential Summer Overheating

4.1 Cooling Hierarchy

The cooling hierarchy has been followed in order to reduce the demand for cooling. The following categories have been considered:

1. Minimising internal heat generation through energy efficient design – minimised heat distribution infrastructure within the buildings.
2. Reducing the amount of heat entering the building during summer – the location, proportion and specification of the glazing should aim to balance natural light and 'beneficial' solar gain whilst ensuring that levels of heat gain are not excessive.
3. Use of thermal mass and high ceilings to manage heat within the building – higher thermal mass construction enables heat to be absorbed in the day and then released at night, however, a balance must be struck. Lightweight structures without the energy-absorption potential are often at risk of overheating.
4. Passive ventilation – providing openable windows to allow natural ventilation and night-time cooling to comply with Part F of the Building Regulations. Low temperature air from external is allowed into the building during the night and circulates throughout the building cooling the building fabric.
5. Mechanical ventilation - this can be used to make use of free cooling when the outside air temperature is below that in the building during summer months, through the use of a summer by-pass on the MVHR.

Full overheating assessment will be completed at detailed application stage.

5 'Be Clean' – Heating Infrastructure

5.1 District Heating – Connection to Existing Scheme

The site has been investigated for connection to an existing or proposed heat network, in line with the heating hierarchy.

There are no local heat networks in the area for connection.

5.2 'Be Clean' Results

Since there are no changes proposed, the 'be clean' results are identical to those at the end of the 'be lean' stage.

6 ‘Be Green’ – Renewable Energy

6.1 Heat Pumps

Heat pumps collect low-temperature heat from renewable sources and “concentrate” it to a usable temperature. Grid electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy.

With the decarbonisation of the grid, the carbon factor associated with electricity is much lower, as we rely more heavily on renewable sources such as wind power, over fossil fuel fired power stations. This makes heat pumps a low carbon energy source.

The houses will receive monobloc air source heat pumps providing the heating and hot water.

Heat pump hot water cylinders have been proposed for the apartments for this scheme. A heat pump cylinder is a cylinder with a small heat pump on top. It’s designed to provide all the hot water needed in the home for a fraction of the energy, normally consumed by an equivalent gas or electric system.

The units have been designed to ensure there are minimal heat losses through a fabric first approach and low air permeability target.

6.2 PV panels

PV systems convert energy from the sun into electricity via semi-conductor cells. There are a wide range of different panels available on the market, from less expensive amorphous silicon with low efficiencies to mono-crystalline silicon with much higher efficiencies (1kWp installation requires approximately 6m2 of free roof area).

Ideally PV panels need to be positioned within 30° South and at an angle of 30° to achieve optimum performance. It is essential that PV panels are unshaded, as even a small amount of shading dramatically reduces the output of the panel. The applicant will be selecting high performance PV panels of at least 400 watts per panel.

There is sufficient space on the roof to provide an array of PV panels. Allowing space for access hatching as well as maintenance and avoiding areas of roof which are shaded by other blocks, the available roof area has been maximised.

The following PV is proposed to be connected to landlord’s supply for apartments and direct to houses:

Apartments 0.5kWp

Houses 2kWp

6.3 ‘Be Green’ Results

A sample of SAP calculations for the dwellings have been completed using the ‘Be Green’ specification of electric panel heaters, heat pump hot water cylinders and PV panels, to achieve a 68% carbon reduction on site.

	Carbon dioxide emissions (tonnes CO_2 per annum)
	Site wide
Baseline: Part L 2021 of the Building Regulations compliant development	91.4
After fabric efficiency (Be Lean)	19.3
After renewable energy (Be Green)	61.9
% carbon reduction	68%

Table 6.1 Sitewide carbon savings

The scheme has been designed to exceed the requirements of the Future Homes Standard which is currently in consultation and due to for release towards the end of 2025.

7 Waste Reduction and Recycling

This section will cover the following policies:

- Mid Sussex District Plan: DP39 – Sustainability Design and Construction

DP39: Sustainable Design and Construction expect all developments to maximise efficient use of resources, including minimising waste and maximising recycling/ re-use of materials through both construction and occupation.

7.1 Reuse and Recycling

Contractors will be held accountable for establishing take-back agreements with suppliers for any packaging materials associated with the project. This proactive approach will ensure that packaging is returned to the manufacturers for reuse or recycling, thereby promoting a circular economy and minimizing landfill contributions.

It is encouraged that contractors are to implement innovative on-site initiatives aimed at reusing materials when feasible. For instance, salvaged timber and other reusable materials can find new life in various applications, reducing the need for new materials and contributing to our sustainability goals. Not only does this practice support environmental stewardship, but it also often proves to be cost-effective in the long term.

In addition to these measures, we will ensure that suitable excavation waste is identified and repurposed for backfill wherever possible. This strategy not only helps in managing waste effectively but also preserves valuable resources by avoiding the need to source new fill materials.

7.2 Operational Waste

The development will emphasise the integration of best practices and relevant planning policies into its overall design and construction.

All waste storage facilities will be developed in strict accordance with the established Mid Sussex standards, ensuring that we meet local regulatory requirements for the management of general waste and recyclable materials.

All facilities designated for recyclable materials will be clearly labelled. This labelling will include detailed identification of the types of materials acceptable for recycling, such as plastics, paper, glass, and metals. By providing clear and concise information, it is intended to educate tenants on proper recycling practices, which will not only improve recycling rates but also contribute to a culture of environmental awareness within the community.

8 Pollution

This Section will cover the following policies:

- Mid Sussex District Plan: DP29 – Noise, Air and Light Pollution

DP29: Noise, Air and Light Pollution states that the environment, including nationally designated environmental sites, nationally protected landscapes, areas of nature conservation or geological interest, wildlife habitats, and the quality of people's life will be protected from unacceptable levels of noise, light and air pollution.

8.1 Noise

The Mid Sussex District Plan states that new developments must be designed, located and controlled to minimise the impact of noise on health and quality of life, neighbouring properties and the surrounding area. If it is likely to generate significant levels of noise, it incorporates appropriate noise attenuation measures.

Noise sensitive development, such as residential, will not be permitted in close proximity to existing or proposed development generating high levels of noise unless adequate sound insulation measures, as supported by a noise assessment are incorporated within the development.

A noise assessment has been completed by Entran Ltd. to consider the noise levels at the proposed residential development and the existing ambient noise and the suitability of the site for residential use. Ambient noise levels are considered to satisfy the criteria provided within BS 8233 and WHO with the incorporation of suitable glazing and attenuated ventilation. With consideration to the proposed layout and the frequency of night-time maximum events, no specific mitigation requirements are identified.

Typical insulated double glazing and attenuated trickle ventilation is calculated to be sufficient across the site. Whilst specific mitigation is not required, it would be prudent to ensure that glazing and ventilation at facades to the north of the site should be selected to achieve the reductions presented in Figure B3 as a minimum. Windows are not required to be sealed and may remain openable for rapid or purge ventilation or to be opened at the occupant's discretion.

8.2 Light Pollution

The District Plan further states that the impact on local amenity, intrinsically dark landscapes and nature conservation areas of artificial lighting proposals (including floodlighting) is minimised, in terms of intensity and number of fittings.

The applicant will demonstrate good design including fittings to restrict emissions from proposed lighting schemes.

8.3 Air Pollution

The District Plan states that the development should not cause unacceptable levels of air pollution, and ensure the development on land adjacent to an existing use which generates air pollution or odour would not cause any adverse effects on the proposed development or can be mitigated to reduce exposure to poor air quality to recognised and acceptable levels.

Entran Ltd have produced an air quality assessment. An assessment of the potential impacts during the construction phase has been carried out in accordance with the latest Institute of Air Quality Management Guidance. This has shown that for the Proposed Development, limited releases of dust and particulate matter are likely to be generated from on-site activities. However, through good site practice and the implementation of suitable mitigation measures, the impact of dust and particulate matter releases may be effectively mitigated and the resultant impacts are considered to be negligible.

ADMS Roads dispersion modelling has been carried out to assess the suitability of the Site for its proposed end use with regards to local air quality. The results indicate that predicted concentrations of relevant pollutants (NO_2, PM_{10} and $PM_{2.5}$) concentrations are below the relevant objectives within the Proposed Development.

It is concluded that air quality does not pose a constraint to the Proposed Development, either during construction or once operational.

9 Sustainable Transport Methods

This section will cover the following:

- Mid Sussex District Plan: DP21 - Transport

The regional and local policies call for a reduction in the use of cars and increase in the use of suitable transport means such as public transport, cycling and walking. It encourages new developments to consider improvements to the pedestrian and cycling environment and promote the use of more sustainable modes of transport. Developments should seek to reduce dependence on car journeys through initiatives such as restricting parking, providing sufficient secure cycle parking spaces and enhancing the local environment to encourage walking and use of public transport.

9.1 Public Transport

The Transport Assessment completed by Transport Planning Associates shows the location of the site has been shown to be sustainable when considering access to and from the site by modes of travel other than the private car, mainly walking, cycling and public transport. It has been demonstrated that the local primary school, secondary school and local amenities are within nationally acceptable walking and cycling distances. The bus stops in the vicinity of the site provide connections to main urban centres making bus travel a viable option for some of the residents of the site. Rail services to a variety of destinations including London, Brighton, Cambridge and Portsmouth accessible via bus and cycle. The access strategy maximises access via sustainable modes and the proposal includes measures to encourage travel by non-car modes.

9.2 Local Amenities

The Proposed Development is ideally located within a close proximity to a wide range of amenities. Food stores, schools, parks and a pharmacy can all be accessed via pedestrian routes within 1700m from the Site.

9.3 Cycling

Numerous settlements including East Grinstead, Gatwick Airport and Crawley are located within an 8km cycle of the site, but it is acknowledged that there is limited cycle infrastructure in the vicinity of the site assisting the less proficient cyclists.

10 Water

This section will cover the following:

- Mid Sussex District Plan: DP41 – Flood Risk and Drainage
- Mid Sussex District Plan: DP42 – Water Infrastructure and the Water Environment

10.1 Flood Risk Management

A Flood Risk Management report has been prepared for planning application by BdR Civil & Structural Engineering Consultants and confirms that the chance of flooding is low to none. There is a low risk of flooding from land, groundwater and sewers.

Flood Risk can be mitigated to a negligible or low and acceptable level through the following approach.

- Ground floor finished floor levels will be set at a minimum 150mm above existing ground levels
- On-site surface water drainage design will meet the design standards required of Approved Document H of the Building Regulations, The National Standards for Sustainable Drainage Systems June 2025 and best practice guidance given in C753 the SUDS Manual 2015.

10.2 Water efficiency

The target for water consumption in the house has been targeted to the requirements of Part G as well as the targets of the Mid Sussex District Plan, to meet a target of 110 litres/person/day.

	Fitting
WC	6/4 l dual flush
Shower	8 l/min
Bath	150 litres
Basin taps	4 l/min
Kitchen sink taps	4 l/min
Dishwasher	4.5 l/place setting
Washing machine	17.16 l/kg

11 Ecology and biodiversity

This section will cover the following:

- Mid Sussex District Plan: DP38 - Biodiversity

The objective of this policy is to protect valued landscapes and create and maintain easily accessible green infrastructure, green corridors and spaces around and within the towns and villages to act as wildlife corridors, sustainable transport links and leisure and recreational routes.

11.1 Ecology

Lloyd Bore have provided an Ecological Impact Assessment (EcIA) for the scheme. It identified important ecological features such as hedgerows, reptiles, birds, dormice and invertebrates. They have recommended suitable avoidance, mitigation, compensation and enhancement measures designed to minimise the significance of the potential impacts of development upon these important ecological features.

The applicant will commit to follow the recommendations in the report to avoid the potential adverse effects and reduce effects on habitats and species during the construction phase through a Construction Environment Management Plan. There will be long term beneficial effects of local significance upon habitats and species from habitat creation and enhancement measures.

The biodiversity matrix has been completed which shows that the total net change in area habitat units is an increase of 11.15%, with hedgerows increasing by 23.96%.

12 Conclusion

This energy strategy outlines the key features and strategies adopted by the design team to reduce energy use and carbon emissions for the scheme. It demonstrates compliance with the building regulations Part L1A, as well as the Mid Sussex District Plan.

The strategy for reducing energy and associated carbon emissions follows the energy hierarchy:

- **Be Lean** – improved building fabric specification to exceed that of the notional building, low air permeability target, thermal bridging details and selection of energy efficient services
- **Be Clean** – connection to a district heat network and installation of Combined Heat and Power (CHP) have been investigated for the site and have not been deemed either available or appropriate at this time.
- **Be Green** – Electric panel heaters for heating and highly efficient heat pump hot water cylinders are to be installed to the apartments as well as ASHPs in the houses. Photovoltaic panels installed on the roof of the houses and apartments.

The scheme is compliant with the sustainability policies as set out in the Mid Sussex Local Plan.

This report concludes that the proposed development at Courthouse Farm will achieve a **79%** improvement over Part L1 2021 of the Building Regulations.

The final specification to meet the 79% carbon reduction on site is as follows:

	Apartment	Houses
Heating	Electric panel heater	ASHP
Hot water	Heat pump hot water cylinder	From ASHP
Emitter	Panel heaters	Radiators
Cooling	N/A	N/A
Ventilation	MVHR	Natural
Lighting	100% low energy 100lm/cW	100% low energy 100lm/cW
Renewable technology	PV panels 0.5kWp per apartment	PV panels 2kWp per house

Table 12.1 Summary of specification to exceed the building regulations

Appendix A – SAP Outputs

Full SAP Calculation Printout

Property Reference	2B4P - Aff + Mkt North	**Issued on Date**	30/10/2025
Assessment Reference	2B4P - Aff + Mkt	**Prop Type Ref**	001 Egerton
Property	001 , Egerton Avenue, Hextable		

SAP Rating	81 B	**DER**	3.60	**TER**	11.22
Environmental	97 A	**% DER < TER**			67.91
CO_2 Emissions (t/year)	0.19	**DFEE**	27.70	**TFEE**	34.06
Compliance Check	See BREL	**% DFEE < TFEE**			18.66
% DPER < TPER	38.98	**DPER**	35.76	**TPER**	58.60

Assessor Details	Mrs. Ellen Huelin	**Assessor ID**	W281-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	37.0100 (1b)	x	2.4000 (2b)	=	88.8240	(1b) - (3b)
First floor	37.0100 (1c)	x	2.6000 (2c)	=	96.2260	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.0200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	185.0500	(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) =	0.1081	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3581	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3312	(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	0.4223	0.4140	0.4057	0.3643	0.3561	0.3147	0.3147	0.3064	0.3312	0.3561	0.3726	0.3892	(22b)
Effective ac	0.5892	0.5857	0.5823	0.5664	0.5634	0.5495	0.5495	0.5469	0.5549	0.5634	0.5694	0.5757	(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								
Window			9.7900	1.1450	11.2099			(27)
Door			1.9800	1.2000	2.3760			(26)
Heatloss Floor 1			37.0100	0.1200	4.4412	75.0000	2775.7500	(28a)
External Wall	86.0500	11.7700	74.2800	0.1500	11.1420	110.0000	8170.8003	(29a)
External Roof	37.0100		37.0100	0.1200	4.4412	9.0000	333.0900	(30)
Total net area of external elements Aum(A, m2)			160.0700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.6103			(33)
Main dwelling								
Party Wall			42.1000	0.0000	0.0000	110.0000	4630.9998	(32)
Internal Wall 1			132.6500			75.0000	9948.7495	(32c)
Internal Floor 1			37.0100			18.0000	666.1800	(32d)
Internal Ceiling 1			37.0100			9.0000	333.0900	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	26858.6597 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		362.8568 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	8.7900	0.0270	0.2373
P1 Party wall - Ground floor	8.4200	0.0360	0.3031

P4 Party wall - Roof (insulation at ceiling level)	8.4200	0.0330	0.2779	
P2 Party wall - Intermediate floor within a dwelling	8.4200	0.0000	0.0000	
E1 Steel lintel with perforated steel base plate	9.9800	0.0600	0.5988	
E4 Jamb	21.4000	0.0190	0.4066	
E3 Sill	7.4800	0.0110	0.0823	
E16 Corner (normal)	10.0000	0.0310	0.3100	
E17 Corner (inverted - internal area greater than external area)	0.0000	-0.0600	-0.0000	
E18 Party wall between dwellings	10.0000	0.0650	0.6500	
E5 Ground floor (normal)	17.2100	0.0460	0.7917	
E12 Gable (insulation at ceiling level)	3.1200	0.0560	0.1747	
E6 Intermediate floor within a dwelling	17.2100	0.0050	0.0861	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.9184	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	37.5287	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.9787	35.7673	35.5600	34.5865	34.4043	33.5564	33.5564	33.3994	33.8830	34.4043	34.7728	35.1580	(38)
Heat transfer coeff	73.5074	73.2960	73.0887	72.1152	71.9331	71.0852	71.0852	70.9281	71.4118	71.9331	72.3015	72.6868	(39)
Average = Sum(39)m / 12 =												72.1143	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9931	0.9902	0.9874	0.9743	0.9718	0.9604	0.9604	0.9582	0.9648	0.9718	0.9768	0.9820	(40)
HLP (average)												0.9743	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3396	(42)
Hot water usage for mixer showers	63.4477	62.4942	61.1048	58.4464	56.4845	54.2967	53.0531	54.4320	55.9436	58.2926	61.0082	63.2046	(42a)
Hot water usage for baths	27.4078	27.0008	26.4276	25.3707	24.5793	23.7018	23.2278	23.7970	24.4167	25.3557	26.4344	27.3152	(42b)
Hot water usage for other uses	38.5902	37.1870	35.7837	34.3804	32.9771	31.5738	31.5738	32.9771	34.3804	35.7837	37.1870	38.5902	(42c)
Average daily hot water use (litres/day)												118.9901	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.4458	126.6820	123.3160	118.1975	114.0409	109.5723	107.8547	111.2061	114.7407	119.4320	124.6295	129.1100	(44)
Energy conte	205.0105	180.3934	189.5322	161.8064	153.5210	134.7319	130.4410	137.6964	141.4868	162.0681	177.5576	202.1551	(45)
Energy content (annual)											Total = Sum(45)m =	1976.4003	
Distribution loss (46)m = 0.15 x (45)m	30.7516	27.0590	28.4298	24.2710	23.0282	20.2098	19.5661	20.6545	21.2230	24.3102	26.6336	30.3233	(46)
Water storage 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	231.9619	204.7366	216.4836	187.8884	180.4724	160.8139	157.3924	164.6478	167.5688	189.0195	203.6396	229.1065	(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	231.9619	204.7366	216.4836	187.8884	180.4724	160.8139	157.3924	164.6478	167.5688	189.0195	203.6396	229.1065	(64)
										Total per year (kWh/year) = Sum(64)m =		2293.7313	(64)
12Total per year (kWh/year)												2294	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	68.1660	59.9808	63.0194	53.8006	51.0457	44.7984	43.3716	45.7841	47.0443	53.8877	59.0379	67.2166	(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	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.5787	120.2121	108.5787	112.1980	108.5787	112.1980	108.5787	108.5787	112.1980	108.5787	112.1980	108.5787	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	206.4921	208.6348	203.2352	191.7400	177.2293	163.5914	154.4804	152.3377	157.7373	169.2325	183.7431	197.3811	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	(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)	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	(71)
Water heating gains (Table 5)	91.6209	89.2572	84.7036	74.7231	68.6099	62.2200	58.2952	61.5377	65.3394	72.4296	81.9971	90.3449	(72)
Total internal gains	464.7863	476.1987	454.6120	436.7556	412.5125	396.1040	379.4489	380.5487	393.3693	408.3355	436.0328	454.3992	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.5200	19.6403	0.6300	0.8500	0.7700	25.6556	(76)
South	6.2700	46.7521	0.6300	0.8500	0.7700	108.7830	(78)

Solar gains	134.4386	228.3464	309.5946	377.0375	415.0132	408.4517	395.2984	367.7422	333.1961	251.7128	160.9345	115.0965	(83)
Total gains	599.2249	704.5451	764.2066	813.7932	827.5257	804.5556	774.7473	748.2909	726.5654	660.0483	596.9673	569.4957	(84)

---

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	101.4964	101.7892	102.0778	103.4558	103.7178	104.9550	104.9550	105.1873	104.4749	103.7178	103.1892	102.6423	
alpha	7.7664	7.7859	7.8052	7.8971	7.9145	7.9970	7.9970	8.0125	7.9650	7.9145	7.8793	7.8428	
util living area	0.9980	0.9927	0.9770	0.9160	0.7746	0.5629	0.4035	0.4357	0.6680	0.9350	0.9932	0.9987	(86)
MIT	20.3136	20.4757	20.6583	20.8610	20.9694	20.9977	20.9999	20.9997	20.9919	20.8568	20.5497	20.2876	(87)
Th 2	20.0891	20.0915	20.0938	20.1048	20.1069	20.1165	20.1165	20.1183	20.1128	20.1069	20.1027	20.0984	(88)
util rest of house	0.9971	0.9894	0.9670	0.8844	0.7133	0.4866	0.3226	0.3524	0.5873	0.9029	0.9896	0.9980	(89)
MIT 2	19.3013	19.5087	19.7374	19.9810	20.0866	20.1156	20.1165	20.1182	20.1090	19.9836	19.6129	19.2756	(90)
Living area fraction										fLA = Living area / (4) =		0.2599	(91)
MIT	19.5644	19.7601	19.9767	20.2097	20.3160	20.3449	20.3461	20.3474	20.3385	20.2105	19.8564	19.5386	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5644	19.7601	19.9767	20.2097	20.3160	20.3449	20.3461	20.3474	20.3385	20.2105	19.8564	19.5386	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9879	0.9654	0.8886	0.7283	0.5065	0.3437	0.3741	0.6083	0.9072	0.9883	0.9975	(94)
Useful gains	597.0773	695.9869	737.7465	723.1258	602.6899	407.4866	266.2575	279.9125	441.9557	598.8279	589.9843	568.0570	(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	1122.0498	1089.1827	984.9976	815.6032	619.7777	408.3764	266.2916	279.9790	445.5028	691.3160	922.3071	1114.9145	(97)
Space heating kWh	390.5796	264.2275	183.9548	66.5837	12.7134	0.0000	0.0000	0.0000	0.0000	68.8111	239.2724	406.8620	(98a)
Space heating requirement - total per year (kWh/year)												1633.0045	
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	390.5796	264.2275	183.9548	66.5837	12.7134	0.0000	0.0000	0.0000	0.0000	68.8111	239.2724	406.8620	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1633.0045	
Space heating per m2										(98c) / (4) =		22.0617	(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	390.5796	264.2275	183.9548	66.5837	12.7134	0.0000	0.0000	0.0000	0.0000	68.8111	239.2724	406.8620	(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)	390.5796	264.2275	183.9548	66.5837	12.7134	0.0000	0.0000	0.0000	0.0000	68.8111	239.2724	406.8620	(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	231.9619	204.7366	216.4836	187.8884	180.4724	160.8139	157.3924	164.6478	167.5688	189.0195	203.6396	229.1065	(64)
Efficiency of water heater												343.4598	(216)
(217)m	343.4598	343.4598	343.4598	343.4598	343.4598	343.4598	343.4598	343.4598	343.4598	343.4598	343.4598	343.4598	(217)
Fuel for water heating, kWh/month	67.5368	59.6101	63.0302	54.7046	52.5454	46.8218	45.8256	47.9380	48.7885	55.0340	59.2907	66.7055	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	21.9088	17.5761	15.8253	11.5943	8.9558	7.3169	8.1698	10.6194	13.7935	18.0978	20.4414	22.5178	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.5472	-56.7922	-83.1693	-90.3706	-93.2997	-85.6801	-84.4447	-79.1806	-69.5763	-60.8777	-42.5109	-33.0336	(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												1633.0045	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												343.4598	
Water heating fuel used												667.8311	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	176.8170	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-817.4828	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1660.1698	(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	1633.0045	0.1574	257.0926	(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)	667.8311	0.1412	94.2855	(264)
Space and water heating			351.3780	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	176.8170	0.1443	25.5202	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-817.4828	0.1351	-110.4279	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-110.4279	(269)
Total CO2, kg/year			266.4703	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6000	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1633.0045	1.5828	2584.7270	(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)	667.8311	1.5221	1016.4740	(278)
Space and water heating			3601.2009	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	176.8170	1.5338	271.2078	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-817.4828	1.4993	-1225.6438	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1225.6438	(283)
Total Primary energy kWh/year			2646.7649	(286)
Dwelling Primary energy Rate (DPER)			35.7600	(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	37.0100 (1b)	x	2.4000 (2b)	=	88.8240	(1b) - (3b)
First floor	37.0100 (1c)	x	2.6000 (2c)	=	96.2260	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 74.0200						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	185.0500	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1621	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4121	(18)
Number of sides sheltered		1	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.3812	(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													
	0.4860	0.4765	0.4670	0.4193	0.4098	0.3621	0.3621	0.3526	0.3812	0.4098	0.4289	0.4479	(22b)
Effective ac	0.6181	0.6135	0.6090	0.5879	0.5840	0.5656	0.5656	0.5622	0.5727	0.5840	0.5920	0.6003	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.9800	1.0000	1.9800			(26)
TER Opening Type			9.7900	1.1450	11.2099			(27)
Heatloss Floor 1			37.0100	0.1300	4.8113			(28a)
External Wall	86.0500	11.7700	74.2800	0.1800	13.3704			(29a)
External Roof	37.0100		37.0100	0.1100	4.0711			(30)
Total net area of external elements Aum(A, m2)			160.0700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.4427			(33)
Main dwelling								
Party Wall			42.1000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 362.8568 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	8.7900	0.0600	0.5274
P1 Party wall - Ground floor	8.4200	0.0800	0.6736
P4 Party wall - Roof (insulation at ceiling level)	8.4200	0.1200	1.0104
P2 Party wall - Intermediate floor within a dwelling	8.4200	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	9.9800	0.0500	0.4990
E4 Jamb	21.4000	0.0500	1.0700
E3 Sill	7.4800	0.0500	0.3740
E16 Corner (normal)	10.0000	0.0900	0.9000
E17 Corner (inverted - internal area greater than external area)	0.0000	-0.0900	-0.0000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
E5 Ground floor (normal)	17.2100	0.1600	2.7536
E12 Gable (insulation at ceiling level)	3.1200	0.0600	0.1872
E6 Intermediate floor within a dwelling	17.2100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5952 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 44.0379 (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	37.7463	37.4662	37.1917	35.9022	35.6609	34.5377	34.5377	34.3298	34.9704	35.6609	36.1490	36.6592	(38)
Heat transfer coeff													
	81.7843	81.5042	81.2296	79.9401	79.6988	78.5757	78.5757	78.3677	79.0083	79.6988	80.1869	80.6972	(39)
Average = Sum(39)m / 12 =												79.9389	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1049	1.1011	1.0974	1.0800	1.0767	1.0615	1.0615	1.0587	1.0674	1.0767	1.0833	1.0902	(40)
HLP (average)												1.0800	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3396 (42)

Hot water usage for mixer showers

63.4477	62.4942	61.1048	58.4464	56.4845	54.2967	53.0531	54.4320	55.9436	58.2926	61.0082	63.2046	(42a)

Hot water usage for baths

27.4078	27.0008	26.4276	25.3707	24.5793	23.7018	23.2278	23.7970	24.4167	25.3557	26.4344	27.3152	(42b)

Hot water usage for other uses

38.5902	37.1870	35.7837	34.3804	32.9771	31.5738	31.5738	32.9771	34.3804	35.7837	37.1870	38.5902	(42c)

Average daily hot water use (litres/day) 118.9901 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	129.4458	126.6820	123.3160	118.1975	114.0409	109.5723	107.8547	111.2061	114.7407	119.4320	124.6295	129.1100	(44)
Energy conte	205.0105	180.3934	189.5322	161.8064	153.5210	134.7319	130.4410	137.6964	141.4868	162.0681	177.5576	202.1551	(45)
Energy content (annual)										Total = Sum(45)m =		1976.4003	
Distribution loss (46)m = 0.15 x (45)m													
	30.7516	27.0590	28.4298	24.2710	23.0282	20.2098	19.5661	20.6545	21.2230	24.3102	26.6336	30.3233	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	251.6054	222.4791	236.1271	206.8982	200.1159	179.8238	177.0359	184.2913	186.5786	208.6630	222.6494	248.7500	(62)
WWHRS	-29.0056	-25.6528	-26.8622	-22.2429	-20.7296	-17.7385	-16.6270	-17.6811	-18.3529	-21.6361	-24.5110	-28.4685	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	222.5997	196.8263	209.2649	184.6553	179.3863	162.0853	160.4089	166.6102	168.2257	187.0270	198.1384	220.2815	(64)
										Total per year (kWh/year) = Sum(64)m =		2255.5094	(64)
12Total per year (kWh/year)												2256	(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													
	105.4419	93.6494	100.2954	89.8741	88.3217	80.8718	80.6475	83.0600	83.1178	91.1636	95.1114	104.4925	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	116.9819	(66)

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

	113.1384	125.2604	113.1384	116.9097	113.1384	116.9097	113.1384	113.1384	116.9097	113.1384	116.9097	113.1384	(67)

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

	206.4921	208.6348	203.2352	191.7400	177.2293	163.5914	154.4804	152.3377	157.7373	169.2325	183.7431	197.3811	(68)

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

	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	34.6982	(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)

	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	-93.5855	(71)

Water heating gains (Table 5)

	141.7230	139.3592	134.8056	124.8251	118.7119	112.3220	108.3972	111.6398	115.4414	122.5317	132.0991	140.4469	(72)

Total internal gains

	522.4480	534.3490	512.2737	494.5694	470.1742	450.9177	434.1107	435.2104	448.1830	465.9972	493.8465	512.0610	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.5200	19.6403	0.6300	0.7000	0.7700	21.1282	(76)
South	6.2700	46.7521	0.6300	0.7000	0.7700	89.5860	(78)

Solar gains	110.7142	188.0500	254.9603	310.5015	341.7756	336.3720	325.5399	302.8465	274.3968	207.2929	132.5343	94.7853	(83)
Total gains	633.1622	722.3989	767.2340	805.0709	811.9498	787.2896	759.6505	738.0569	722.5798	673.2901	626.3808	606.8463	(84)

---

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	91.2246	91.5381	91.8475	93.3291	93.6117	94.9497	94.9497	95.2017	94.4298	93.6117	93.0419	92.4535	
alpha	7.0816	7.1025	7.1232	7.2219	7.2408	7.3300	7.3300	7.3468	7.2953	7.2408	7.2028	7.1636	
util living area	0.9977	0.9935	0.9830	0.9428	0.8350	0.6299	0.4543	0.4871	0.7282	0.9492	0.9930	0.9983	(86)
MIT	20.2117	20.3612	20.5446	20.7756	20.9319	20.9925	20.9994	20.9990	20.9795	20.7954	20.4695	20.1931	(87)
Th 2	19.9968	19.9999	20.0030	20.0172	20.0199	20.0324	20.0324	20.0347	20.0276	20.0199	20.0145	20.0088	(88)
util rest of house	0.9966	0.9905	0.9751	0.9171	0.7741	0.5394	0.3549	0.3857	0.6382	0.9208	0.9893	0.9974	(89)
MIT 2	19.0974	19.2897	19.5219	19.8094	19.9721	20.0293	20.0322	20.0345	20.0176	19.8390	19.4397	19.0832	(90)
Living area fraction									fLA = Living area / (4) =			0.2599	(91)
MIT	19.3870	19.5682	19.7878	20.0605	20.2216	20.2797	20.2836	20.2852	20.2677	20.0876	19.7074	19.3717	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3870	19.5682	19.7878	20.0605	20.2216	20.2797	20.2836	20.2852	20.2677	20.0876	19.7074	19.3717	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9888	0.9729	0.9185	0.7877	0.5630	0.3808	0.4122	0.6615	0.9232	0.9877	0.9967	(94)
Useful gains	630.4148	714.2764	746.4281	739.4391	639.5963	443.2412	289.2912	304.2031	477.9811	621.5823	618.6480	604.8342	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1233.8826	1195.5207	1079.3608	892.1728	679.1588	446.2826	289.4432	304.4708	487.2961	756.1515	1010.9468	1224.3127	(97)
Space heating kWh	448.9801	323.3962	247.7020	109.9682	29.4344	0.0000	0.0000	0.0000	0.0000	100.1195	282.4552	460.8921	(98a)
Space heating requirement - total per year (kWh/year)												2002.9476	
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	448.9801	323.3962	247.7020	109.9682	29.4344	0.0000	0.0000	0.0000	0.0000	100.1195	282.4552	460.8921	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2002.9476	
Space heating per m2											(98c) / (4) =	27.0595	(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	448.9801	323.3962	247.7020	109.9682	29.4344	0.0000	0.0000	0.0000	0.0000	100.1195	282.4552	460.8921	(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)	486.4356	350.3751	268.3662	119.1422	31.8900	0.0000	0.0000	0.0000	0.0000	108.4718	306.0186	499.3414	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	222.5997	196.8263	209.2649	184.6553	179.3863	162.0853	160.4089	166.6102	168.2257	187.0270	198.1384	220.2815	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6001	85.1659	84.4389	82.9375	80.9565	79.8000	79.8000	79.8000	79.8000	82.7233	84.8545	85.6753	(217)
Fuel for water heating, kWh/month	260.0462	231.1093	247.8299	222.6440	221.5834	203.1144	201.0136	208.7847	210.8091	226.0874	233.5037	257.1122	(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	23.5079	18.8589	16.9804	12.4406	9.6094	7.8510	8.7661	11.3944	14.8003	19.4187	21.9334	24.1613	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.6943	-48.9395	-70.3811	-79.1752	-85.4135	-79.7455	-78.7768	-74.3682	-66.5664	-56.0049	-38.1594	-29.9934	(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	-19.4957	-41.0335	-81.5964	-122.6045	-162.1591	-162.9414	-161.0069	-136.2846	-99.8522	-58.6771	-26.0291	-15.4134	(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	2170.0408	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2723.6380	(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)	189.7224	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1829.3119	(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	3340.0893	(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	2170.0408	0.2100	455.7086	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2723.6380	0.2100	571.9640	(264)
Space and water heating			1027.6725	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	189.7224	0.1443	27.3828	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-742.2182	0.1346	-99.8821	
PV Unit electricity exported	-1087.0937	0.1259	-136.8493	
Total			-236.7314	(269)
Total CO2, kg/year			830.2532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.2200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2170.0408	1.1300	2452.1460	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2723.6380	1.1300	3077.7110	(278)
Space and water heating			5529.8570	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	189.7224	1.5338	291.0026	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-742.2182	1.4974	-1111.3650	
PV Unit electricity exported	-1087.0937	0.4621	-502.3307	
Total			-1613.6957	(283)
Total Primary energy kWh/year			4337.2647	(286)
Target Primary Energy Rate (TPER)			58.6000	(287)

Full SAP Calculation Printout

Property Reference	4B8P - Aff + Mkt	**Issued on Date**	30/10/2025
Assessment Reference	4B8P - Aff + Mkt	**Prop Type Ref**	001 Egerton
Property	001 , Egerton Avenue, Hextable		

SAP Rating	71 C	**DER**	5.40	**TER**	10.70
Environmental	95 A	**% DER < TER**			49.53
CO_2 Emissions (t/year)	0.6	**DFEE**	38.55	**TFEE**	45.00
Compliance Check	See BREL	**% DFEE < TFEE**			14.34
% DPER < TPER	3.26	**DPER**	54.32	**TPER**	56.15

Assessor Details	Mrs. Ellen Huelin	**Assessor ID**	W281-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	70.7700 (1b)	x	2.4000 (2b)	=	169.8480	(1b) - (3b)
First floor	70.7700 (1c)	x	2.6000 (2c)	=	184.0020	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	141.5400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	353.8500	(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) =	0.0565	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3065	(18)
Number of sides sheltered			0	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3065	(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	0.3908	0.3832	0.3755	0.3372	0.3295	0.2912	0.2912	0.2835	0.3065	0.3295	0.3448	0.3602	(22b)
Effective ac	0.5764	0.5734	0.5705	0.5568	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(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								
Window			24.0000	1.1450	27.4809			(27)
Door			1.9800	1.2000	2.3760			(26)
Heatloss Floor 1			70.7700	0.1200	8.4924	75.0000	5307.7500	(28a)
Exposed Floor			3.6200	0.1200	0.4344	0.0000	0.0000	(28b)
External Wall	193.8500	25.9800	167.8700	0.1500	25.1805	110.0000	18465.7007	(29a)
External Roof	87.7100		87.7100	0.1200	10.5252	9.0000	789.3900	(30)
Total net area of external elements Aum(A, m2)			355.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.4894			(33)
Main dwelling								
Internal Wall 1			281.0000			75.0000	21075.0000	(32c)
Internal Floor 1			70.7700			18.0000	1273.8600	(32d)
Internal Ceiling 1			70.7700			9.0000	636.9300	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		47548.6307	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							335.9378	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	23.8300	0.0270	0.6434
P1 Party wall - Ground floor	0.0000	0.0360	0.0000

P4 Party wall - Roof (insulation at ceiling level)	0.0000	0.0330	0.0000	
P2 Party wall - Intermediate floor within a dwelling	0.0000	0.0000	0.0000	
E1 Steel lintel with perforated steel base plate	16.0500	0.0600	0.9630	
E4 Jamb	46.9000	0.0190	0.8911	
E3 Sill	12.5300	0.0110	0.1378	
E16 Corner (normal)	25.0000	0.0310	0.7750	
E17 Corner (inverted - internal area greater than external area)	10.0000	-0.0600	-0.6000	
E18 Party wall between dwellings	0.0000	0.0650	0.0000	
E5 Ground floor (normal)	38.2000	0.0460	1.7572	
E12 Gable (insulation at ceiling level)	14.3700	0.0560	0.8047	
E6 Intermediate floor within a dwelling	38.1500	0.0050	0.1908	
E14 Flat roof	7.0300	0.1600	1.1248	
E20 Exposed floor (normal)	7.0300	0.3200	2.2496	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9374 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 83.4268 (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	67.3028	66.9565	66.6171	65.0228	64.7245	63.3360	63.3360	63.0789	63.8708	64.7245	65.3280	65.9588	(38)
Heat transfer coeff	150.7296	150.3833	150.0439	148.4496	148.1514	146.7628	146.7628	146.5057	147.2977	148.1514	148.7548	149.3856	(39)
Average = Sum(39)m / 12 =												148.4482	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0649	1.0625	1.0601	1.0488	1.0467	1.0369	1.0369	1.0351	1.0407	1.0467	1.0510	1.0554	(40)
HLP (average)												1.0488	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9200 (42)
Hot water usage for mixer showers

73.1780	72.0782	70.4757	67.4096	65.1469	62.6235	61.1893	62.7796	64.5230	67.2323	70.3643	72.8976	(42a)

Hot water usage for baths

31.5921	31.1230	30.4622	29.2440	28.3318	27.3203	26.7740	27.4300	28.1444	29.2267	30.4701	31.4853	(42b)

Hot water usage for other uses

44.5333	42.9139	41.2945	39.6751	38.0557	36.4363	36.4363	38.0557	39.6751	41.2945	42.9139	44.5333	(42c)

Average daily hot water use (litres/day) 137.2433 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3034	146.1151	142.2325	136.3287	131.5344	126.3802	124.3995	128.2654	132.3425	137.7536	143.7483	148.9162	(44)
Energy conte	236.4601	208.0660	218.6060	186.6272	177.0706	155.3992	150.4505	158.8194	163.1916	186.9303	204.7958	233.1668	(45)
Energy content (annual)										Total = Sum(45)m =		2279.5834	
Distribution loss (46)m = 0.15 x (45)m	35.4690	31.2099	32.7909	27.9941	26.5606	23.3099	22.5676	23.8229	24.4787	28.0395	30.7194	34.9750	(46)
Water storage 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	263.4115	232.4092	245.5574	212.7092	204.0220	181.4812	177.4019	185.7708	189.2736	213.8817	230.8778	260.1182	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	263.4115	232.4092	245.5574	212.7092	204.0220	181.4812	177.4019	185.7708	189.2736	213.8817	230.8778	260.1182	(64)
										Total per year (kWh/year) = Sum(64)m =		2596.9144	(64)
12Total per year (kWh/year)												2597	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	78.6230	69.1819	72.6865	62.0536	58.8760	51.6702	50.0248	52.8074	54.2612	62.1543	68.0946	77.5280	(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	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	157.6138	174.5010	157.6138	162.8676	157.6138	162.8676	157.6138	157.6138	162.8676	157.6138	162.8676	157.6138	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	311.1563	314.3851	306.2485	288.9268	267.0612	246.5107	232.7816	229.5528	237.6893	255.0111	276.8767	297.4272	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	(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)	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	(71)
Water heating gains (Table 5)	105.6760	102.9493	97.6969	86.1855	79.1344	71.7642	67.2376	70.9777	75.3628	83.5408	94.5758	104.2043	(72)
Total internal gains	641.2455	658.6348	628.3587	604.7793	570.6088	547.9419	524.4324	524.9437	542.7191	562.9650	601.1195	626.0447	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.9900	10.6334	0.6300	0.8500	0.7700	39.4212	(74)
East	6.0600	19.6403	0.6300	0.8500	0.7700	44.1685	(76)

South				6.4500		46.7521		0.6300		0.8500		0.7700	111.9060 (78)
West				1.5000		19.6403		0.6300		0.8500		0.7700	10.9328 (80)
Solar gains	206.4285	366.3989	538.9862	728.3756	869.2345	885.9352	844.6069	736.3359	604.2451	415.2566	249.9827	174.8731 (83)	
Total gains	847.6740	1025.0337	1167.3448	1333.1549	1439.8433	1433.8771	1369.0394	1261.2797	1146.9643	978.2216	851.1022	800.9178 (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	87.6268	87.8286	88.0273	88.9726	89.1517	89.9952	89.9952	90.1532	89.6684	89.1517	88.7901	88.4152	
alpha	6.8418	6.8552	6.8685	6.9315	6.9434	6.9997	6.9997	7.0102	6.9779	6.9434	6.9193	6.8943	
util living area	0.9996	0.9984	0.9935	0.9640	0.8540	0.6430	0.4704	0.5312	0.8160	0.9840	0.9987	0.9997	(86)
MIT	19.9933	20.1570	20.3871	20.6911	20.9105	20.9895	20.9989	20.9976	20.9513	20.6505	20.2644	19.9683	(87)
Th 2	20.0296	20.0316	20.0336	20.0429	20.0446	20.0527	20.0527	20.0542	20.0496	20.0446	20.0411	20.0374	(88)
util rest of house	0.9994	0.9977	0.9904	0.9469	0.7986	0.5539	0.3699	0.4239	0.7329	0.9734	0.9980	0.9996	(89)
MIT 2	18.8508	19.0620	19.3566	19.7391	19.9776	20.0480	20.0525	20.0536	20.0218	19.6978	19.2073	18.8248	(90)
Living area fraction									fLA = Living area / (4) =			0.1414	(91)
MIT	19.0123	19.2168	19.5023	19.8737	20.1095	20.1811	20.1863	20.1871	20.1532	19.8325	19.3567	18.9865	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0123	19.2168	19.5023	19.8737	20.1095	20.1811	20.1863	20.1871	20.1532	19.8325	19.3567	18.9865	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9968	0.9880	0.9431	0.8028	0.5663	0.3842	0.4391	0.7429	0.9701	0.9973	0.9994	(94)
Useful gains	846.9466	1021.7089	1153.3230	1257.3411	1155.9184	812.0481	525.9280	553.8438	852.0730	949.0118	848.7658	800.4495	(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	2217.5861	2153.0108	1950.9112	1629.0363	1245.8741	819.1007	526.3305	554.8274	891.6208	1367.8108	1823.2480	2208.8896	(97)
Space heating kWh	1019.7558	760.2349	593.4056	267.6205	66.9270	0.0000	0.0000	0.0000	0.0000	311.5864	701.6272	1047.8795	(98a)
Space heating requirement - total per year (kWh/year)												4769.0370	
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	1019.7558	760.2349	593.4056	267.6205	66.9270	0.0000	0.0000	0.0000	0.0000	311.5864	701.6272	1047.8795	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4769.0370	
Space heating per m2											(98c) / (4) =	33.6939	(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	1019.7558	760.2349	593.4056	267.6205	66.9270	0.0000	0.0000	0.0000	0.0000	311.5864	701.6272	1047.8795	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	1019.7558	760.2349	593.4056	267.6205	66.9270	0.0000	0.0000	0.0000	0.0000	311.5864	701.6272	1047.8795	(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	263.4115	232.4092	245.5574	212.7092	204.0220	181.4812	177.4019	185.7708	189.2736	213.8817	230.8778	260.1182	(64)
Efficiency of water heater												337.6796	(216)
(217)m	337.6796	337.6796	337.6796	337.6796	337.6796	337.6796	337.6796	337.6796	337.6796	337.6796	337.6796	337.6796	(217)
Fuel for water heating, kWh/month	78.0063	68.8253	72.7191	62.9914	60.4188	53.7436	52.5356	55.0139	56.0512	63.3386	68.3718	77.0311	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.0736	27.3351	24.6123	18.0320	13.9284	11.3796	12.7060	16.5157	21.4523	28.1465	31.7915	35.0206	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.7916	-64.1521	-98.3159	-111.4340	-113.2696	-100.6030	-99.1384	-91.8671	-79.2872	-72.2183	-47.2348	-35.5534	(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												4769.0370	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	337.6796	
Water heating fuel used	769.0468	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	274.9937	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-954.8655	(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	4858.2121	(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	4769.0370	0.1562	744.8788	(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)	769.0468	0.1412	108.6109	(264)
Space and water heating			853.4897	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	274.9937	0.1443	39.6901	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-954.8655	0.1349	-128.7936	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-128.7936	(269)
Total CO2, kg/year			764.3862	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.4000	(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	4769.0370	1.5782	7526.7028	(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)	769.0468	1.5222	1170.6631	(278)
Space and water heating			8697.3659	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	274.9937	1.5338	421.7945	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-954.8655	1.4986	-1430.9150	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1430.9150	(283)
Total Primary energy kWh/year			7688.2454	(286)
Dwelling Primary energy Rate (DPER)			54.3200	(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	70.7700 (1b)	x	2.4000 (2b)	=	169.8480	(1b) - (3b)
First floor	70.7700 (1c)	x	2.6000 (2c)	=	184.0020	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 141.5400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	353.8500	(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) =	0.1130	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3630	(18)
Number of sides sheltered		0	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3630 (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	0.4629	0.4538	0.4447	0.3993	0.3903	0.3449	0.3449	0.3358	0.3630	0.3903	0.4084	0.4266	(22b)
Effective ac	0.6071	0.6030	0.5989	0.5797	0.5762	0.5595	0.5595	0.5564	0.5659	0.5762	0.5834	0.5910	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			1.9800	1.0000	1.9800			(26)
TER Opening Type			24.0000	1.1450	27.4809			(27)
Heatloss Floor 1			70.7700	0.1300	9.2001			(28a)
Exposed Floor			3.6200	0.1300	0.4706			(28b)
External Wall	193.8500	25.9800	167.8700	0.1800	30.2166			(29a)
External Roof	87.7100		87.7100	0.1100	9.6481			(30)
Total net area of external elements Aum(A, m2)			355.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.9963			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 335.9378 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	23.8300	0.0600	1.4298
P1 Party wall - Ground floor	0.0000	0.0800	0.0000
P4 Party wall - Roof (insulation at ceiling level)	0.0000	0.1200	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.0000	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	16.0500	0.0500	0.8025
E4 Jamb	46.9000	0.0500	2.3450
E3 Sill	12.5300	0.0500	0.6265
E16 Corner (normal)	25.0000	0.0900	2.2500
E17 Corner (inverted - internal area greater than external area)	10.0000	-0.0900	-0.9000
E18 Party wall between dwellings	0.0000	0.0600	0.0000
E5 Ground floor (normal)	38.2000	0.1600	6.1120
E12 Gable (insulation at ceiling level)	14.3700	0.0600	0.8622
E6 Intermediate floor within a dwelling	38.1500	0.0000	0.0000
E14 Flat roof	7.0300	0.0800	0.5624
E20 Exposed floor (normal)	7.0300	0.3200	2.2496

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 16.3400 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 95.3363 (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	70.8947	70.4089	69.9328	67.6964	67.2780	65.3301	65.3301	64.9694	66.0804	67.2780	68.1244	69.0094	(38)
Heat transfer coeff	166.2310	165.7452	165.2691	163.0327	162.6143	160.6664	160.6664	160.3057	161.4167	162.6143	163.4607	164.3457	(39)
Average = Sum(39)m / 12 =												163.0307	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1744	1.1710	1.1676	1.1518	1.1489	1.1351	1.1351	1.1326	1.1404	1.1489	1.1549	1.1611	(40)
HLP (average)												1.1518	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9200 (42)
Hot water usage for mixer showers

73.1780	72.0782	70.4757	67.4096	65.1469	62.6235	61.1893	62.7796	64.5230	67.2323	70.3643	72.8976	(42a)

Hot water usage for baths

31.5921	31.1230	30.4622	29.2440	28.3318	27.3203	26.7740	27.4300	28.1444	29.2267	30.4701	31.4853	(42b)

Hot water usage for other uses

44.5333	42.9139	41.2945	39.6751	38.0557	36.4363	36.4363	38.0557	39.6751	41.2945	42.9139	44.5333	(42c)

Average daily hot water use (litres/day) 137.2433 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3034	146.1151	142.2325	136.3287	131.5344	126.3802	124.3995	128.2654	132.3425	137.7536	143.7483	148.9162	(44)
Energy conte	236.4601	208.0660	218.6060	186.6272	177.0706	155.3992	150.4505	158.8194	163.1916	186.9303	204.7958	233.1668	(45)
Energy content (annual)										Total = Sum(45)m =		2279.5834	
Distribution loss (46)m = 0.15 x (45)m	35.4690	31.2099	32.7909	27.9941	26.5606	23.3099	22.5676	23.8229	24.4787	28.0395	30.7194	34.9750	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	283.0550	250.1517	265.2009	231.7191	223.6655	200.4910	197.0454	205.4143	208.2834	233.5252	249.8876	279.7617	(62)
WWHRS	-33.4539	-29.5869	-30.9817	-25.6541	-23.9087	-20.4588	-19.1769	-20.3927	-21.1675	-24.9541	-28.2700	-32.8344	(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	249.6011	220.5648	234.2192	206.0650	199.7568	180.0322	177.8685	185.0216	187.1159	208.5711	221.6176	246.9273	(64)
										Total per year (kWh/year) = Sum(64)m =		2517.3610	(64)
12Total per year (kWh/year)												2517	(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	115.8989	102.8505	109.9624	98.1270	96.1519	87.7437	87.3007	90.0834	90.3347	99.4302	104.1681	114.8039	(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	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	145.9980	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	161.9407	179.2915	161.9407	167.3387	161.9407	167.3387	161.9407	161.9407	167.3387	161.9407	167.3387	161.9407	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	311.1563	314.3851	306.2485	288.9268	267.0612	246.5107	232.7816	229.5528	237.6893	255.0111	276.8767	297.4272	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	37.5998	(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)													
	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	-116.7984	(71)
Water heating gains (Table 5)													
	155.7781	153.0513	147.7990	136.2875	129.2364	121.8662	117.3397	121.0798	125.4648	133.6428	144.6779	154.3063	(72)
Total internal gains													
	698.6745	716.5273	685.7876	662.3525	628.0378	602.5151	578.8614	579.3727	597.2923	620.3940	658.6927	683.4736	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.9900	10.6334	0.6300	0.7000	0.7700	32.4645	(74)
East	6.0600	19.6403	0.6300	0.7000	0.7700	36.3741	(76)
South	6.4500	46.7521	0.6300	0.7000	0.7700	92.1579	(78)
West	1.5000	19.6403	0.6300	0.7000	0.7700	9.0035	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	169.9999	301.7403	443.8710	599.8387	715.8402	729.5937	695.5586	606.3943	497.6136	341.9760	205.8681	144.0132	(83)
Total gains	868.6744	1018.2676	1129.6586	1262.1912	1343.8780	1332.1087	1274.4200	1185.7670	1094.9059	962.3700	864.5608	827.4868	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.4554	79.6883	79.9179	81.0141	81.2226	82.2073	82.2073	82.3923	81.8252	81.2226	80.8020	80.3669	
alpha	6.2970	6.3126	6.3279	6.4009	6.4148	6.4805	6.4805	6.4928	6.4550	6.4148	6.3868	6.3578	
util living area													
	0.9995	0.9986	0.9954	0.9786	0.9105	0.7335	0.5492	0.6108	0.8731	0.9882	0.9987	0.9997	(86)
MIT	19.8678	20.0193	20.2445	20.5609	20.8280	20.9694	20.9958	20.9922	20.9059	20.5592	20.1617	19.8502	(87)
Th 2	19.9405	19.9433	19.9460	19.9587	19.9611	19.9722	19.9722	19.9743	19.9680	19.9611	19.9563	19.9512	(88)
util rest of house													
	0.9993	0.9979	0.9932	0.9670	0.8650	0.6337	0.4242	0.4810	0.7958	0.9799	0.9980	0.9995	(89)
MIT 2	18.6217	18.8178	19.1073	19.5138	19.8228	19.9577	19.9713	19.9723	19.9099	19.5184	19.0104	18.6072	(90)
Living area fraction										fLA = Living area / (4) =		0.1414	(91)
MIT	18.7979	18.9877	19.2681	19.6618	19.9649	20.1007	20.1161	20.1165	20.0507	19.6656	19.1731	18.7830	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7979	18.9877	19.2681	19.6618	19.9649	20.1007	20.1161	20.1165	20.0507	19.6656	19.1731	18.7830	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9970	0.9910	0.9627	0.8652	0.6471	0.4420	0.4996	0.8031	0.9765	0.9971	0.9992	(94)
Useful gains	867.7741	1015.2133	1119.4872	1215.0532	1162.6859	861.9423	563.3095	592.3546	879.3028	939.7448	862.0594	826.8592	(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													
	2409.9935	2334.9652	2110.1646	1754.5328	1343.9928	883.7834	564.9273	595.7713	960.5389	1474.1880	1973.4822	2396.6456	(97)
Space heating kWh													
	1147.4113	886.8733	737.0640	388.4254	134.8923	0.0000	0.0000	0.0000	0.0000	397.6257	800.2244	1167.9211	(98a)
Space heating requirement - total per year (kWh/year)												5660.4374	
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													
	1147.4113	886.8733	737.0640	388.4254	134.8923	0.0000	0.0000	0.0000	0.0000	397.6257	800.2244	1167.9211	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5660.4374	
Space heating per m2											(98c) / (4) =	39.9918	(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													
	1147.4113	886.8733	737.0640	388.4254	134.8923	0.0000	0.0000	0.0000	0.0000	397.6257	800.2244	1167.9211	(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)													
	1243.1325	960.8594	798.5525	420.8292	146.1455	0.0000	0.0000	0.0000	0.0000	430.7971	866.9820	1265.3533	(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

	249.6011	220.5648	234.2192	206.0650	199.7568	180.0322	177.8685	185.0216	187.1159	208.5711	221.6176	246.9273 (64)
Efficiency of water heater												79.8000 (216)
(217)m	87.0460	86.8492	86.4489	85.4591	83.1990	79.8000	79.8000	79.8000	79.8000	85.4829	86.6798	87.0859 (217)
Fuel for water heating, kWh/month												
	286.7463	253.9630	270.9338	241.1269	240.0954	225.6042	222.8928	231.8566	234.4811	243.9916	255.6739	283.5447 (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	33.6481	26.9937	24.3049	17.8068	13.7545	11.2375	12.5473	16.3094	21.1844	27.7950	31.3944	34.5833 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-62.1154	-85.5503	-120.1279	-131.7798	-139.2971	-128.9093	-127.1812	-121.3381	-110.7497	-96.1241	-67.5112	-53.9310 (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	-41.5059	-86.4947	-170.4813	-254.0604	-334.1078	-335.1531	-331.3297	-281.4692	-207.4736	-123.1692	-55.2292	-32.8953 (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	6132.6516 (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	2990.9103 (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)	271.5593 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3497.9844 (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	5983.1368 (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	6132.6516	0.2100	1287.8568	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2990.9103	0.2100	628.0912	(264)
Space and water heating			1915.9480	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	271.5593	0.1443	39.1944	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1244.6150	0.1351	-168.1695	
PV Unit electricity exported	-2253.3694	0.1261	-284.1933	
Total			-452.3628	(269)
Total CO2, kg/year			1514.7089	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.7000	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	6132.6516	1.1300	6929.8963	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2990.9103	1.1300	3379.7287	(278)
Space and water heating			10309.6249	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	271.5593	1.5338	416.5267	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1244.6150	1.4994	-1866.1780	
PV Unit electricity exported	-2253.3694	0.4630	-1043.2060	
Total			-2909.3840	(283)
Total Primary energy kWh/year			7946.8685	(286)
Target Primary Energy Rate (TPER)			56.1500	(287)

Full SAP Calculation Printout

Property Reference	L01 - 69.8	**Issued on Date**	30/10/2025
Assessment Reference	L01 - 69.8	**Prop Type Ref**	001 Egerton
Property	001 , Egerton Avenue, Hextable		

SAP Rating	75 C	**DER**	6.27	**TER**	14.27
Environmental	95 A	**% DER < TER**			56.06
CO_2 Emissions (t/year)	0.35	**DFEE**	44.76	**TFEE**	46.68
Compliance Check	See BREL	**% DFEE < TFEE**			4.11
% DPER < TPER	14.57	**DPER**	64.11	**TPER**	75.04

Assessor Details	Mrs. Ellen Huelin	**Assessor ID**	W281-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	69.8000 (1b)	x	2.4000 (2b)	=	167.5200	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.8000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	167.5200	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	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		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

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) =		68.8000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3473	0.3435	0.3397	0.3210	0.3173	0.2985	0.2985	0.2948	0.3060	0.3173	0.3247	0.3323	(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								
Window			8.4900	1.1450	9.7214			(27)
Door			1.9800	1.2000	2.3760			(26)
Heatloss Floor 1			69.8000	0.1200	8.3760	75.0000	5235.0000	(28a)
External Wall	69.0200	10.4700	58.5500	0.1500	8.7825	110.0000	6440.4996	(29a)
Riser Wall	29.6600		29.6600	0.1800	5.3388	190.0000	5635.4000	(29a)
External Roof 1	69.8000		69.8000	0.1200	8.3760	9.0000	628.2000	(30)
Total net area of external elements Aum(A, m2)			238.2800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.9707			(33)
Main dwelling								
Internal Wall 1			106.3700			75.0000	7977.7502	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25916.8498 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		371.3016 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E10 Eaves (insulation at ceiling level)	14.9400	0.0270	0.4034	
P1 Party wall - Ground floor	0.0000	0.0360	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	0.0000	0.0330	0.0000	
P2 Party wall - Intermediate floor within a dwelling	0.0000	0.0000	0.0000	
E1 Steel lintel with perforated steel base plate	7.2700	0.0600	0.4362	
E4 Jamb	17.3000	0.0190	0.3287	
E3 Sill	4.7700	0.0110	0.0525	
E16 Corner (normal)	16.8000	0.0310	0.5208	
E17 Corner (inverted - internal area greater than external area)	7.2000	-0.0600	-0.4320	
E18 Party wall between dwellings	0.0000	0.0650	0.0000	
E5 Ground floor (normal)	0.0000	0.0460	0.0000	
E12 Gable (insulation at ceiling level)	13.8200	0.0560	0.7739	
E7 Party floor between dwellings (in blocks of flats)	39.0200	0.1400	5.4628	
E14 Flat roof	12.3600	0.1600	1.9776	
E20 Exposed floor (normal)	0.0000	0.3200	0.0000	
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	2.1000	0.5000	1.0500	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5739 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 53.5445 (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	19.1965	18.9892	18.7819	17.7454	17.5381	16.5016	16.5016	16.2943	16.9162	17.5381	17.9527	18.3673	(38)
Heat transfer coeff	72.7411	72.5338	72.3265	71.2899	71.0826	70.0461	70.0461	69.8388	70.4607	71.0826	71.4972	71.9119	(39)

Average = Sum(39)m / 12 = 71.2381

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0421	1.0392	1.0362	1.0213	1.0184	1.0035	1.0035	1.0006	1.0095	1.0184	1.0243	1.0303	(40)
HLP (average)												1.0206	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2413 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	61.7982	60.8695	59.5162	56.9269	55.0160	52.8851	51.6738	53.0169	54.4891	56.7771	59.4221	61.5614	(42a)
Hot water usage for baths	26.6985	26.3020	25.7436	24.7141	23.9432	23.0884	22.6266	23.1811	23.7848	24.6995	25.7502	26.6082	(42b)
Hot water usage for other uses	37.5827	36.2161	34.8494	33.4828	32.1162	30.7495	30.7495	32.1162	33.4828	34.8494	36.2161	37.5827	(42c)

Average daily hot water use (litres/day) 115.8957 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.0794	123.3875	120.1092	115.1237	111.0753	106.7229	105.0500	108.3141	111.7568	116.3261	121.3884	125.7524	(44)
Energy conte	199.6790	175.7022	184.6034	157.5986	149.5288	131.2283	127.0488	134.1155	137.8073	157.8534	172.9400	196.8978	(45)

Energy content (annual) Total = Sum(45)m = 1925.0032

Distribution loss (46)m = 0.15 x (45)m	29.9518	26.3553	27.6905	23.6398	22.4293	19.6842	19.0573	20.1173	20.6711	23.6780	25.9410	29.5347	(46)

Water storage 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	226.6304	200.0454	211.5548	183.6806	176.4802	157.3103	154.0002	161.0669	163.8893	184.8048	199.0220	223.8492	(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	226.6304	200.0454	211.5548	183.6806	176.4802	157.3103	154.0002	161.0669	163.8893	184.8048	199.0220	223.8492	(64)

Total per year (kWh/year) = Sum(64)m = 2242.3342 (64)
12Total per year (kWh/year) 2242 (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	66.3933	58.4210	61.3806	52.4015	49.7183	43.6334	42.2437	44.5934	45.8209	52.4863	57.5026	65.4685	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.2891	116.5700	105.2891	108.7987	105.2891	108.7987	105.2891	105.2891	108.7987	105.2891	108.7987	105.2891	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	196.8298	198.8723	193.7253	182.7680	168.9364	155.9366	147.2520	145.2095	150.3565	161.3138	175.1454	188.1452	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	(71)
Water heating gains (Table 5)	89.2382	86.9360	82.5009	72.7799	66.8257	60.6020	56.7792	59.9374	63.6402	70.5460	79.8647	87.9953	(72)
Total internal gains	447.9760	458.9972	438.1341	420.9655	397.6700	381.9562	365.9391	367.0548	379.4142	393.7677	420.4276	438.0485	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

North				2.1600		10.6334		0.6300		0.8500		0.7700	8.5235 (74)
East				6.3300		19.6403		0.6300		0.8500		0.7700	46.1364 (76)
Solar gains	54.6599	106.5414	176.3119	261.2318	325.5535	336.0680	318.7699	269.8911	206.1453	126.4821	68.0415	45.0459 (83)	
Total gains	502.6359	565.5387	614.4460	682.1973	723.2236	718.0241	684.7090	636.9459	585.5595	520.2498	488.4691	483.0944 (84)	

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	98.9692	99.2520	99.5365	100.9837	101.2783	102.7770	102.7770	103.0820	102.1722	101.2783	100.6909	100.1104	
alpha	7.5979	7.6168	7.6358	7.7322	7.7519	7.8518	7.8518	7.8721	7.8115	7.7519	7.7127	7.6740	
util living area	0.9993	0.9979	0.9929	0.9609	0.8422	0.6184	0.4497	0.5032	0.7894	0.9796	0.9979	0.9995	(86)
MIT	20.1977	20.3203	20.5057	20.7662	20.9413	20.9952	20.9996	20.9992	20.9729	20.7406	20.4285	20.1820	(87)
Th 2	20.0484	20.0508	20.0533	20.0656	20.0680	20.0804	20.0804	20.0829	20.0755	20.0680	20.0631	20.0582	(88)
util rest of house	0.9989	0.9969	0.9893	0.9414	0.7833	0.5328	0.3560	0.4036	0.7028	0.9655	0.9966	0.9992	(89)
MIT 2	19.1187	19.2773	19.5148	19.8428	20.0270	20.0785	20.0803	20.0827	20.0616	19.8206	19.4258	19.1064	(90)
Living area fraction										fLA = Living area / (4) =		0.4284	(91)
MIT	19.5809	19.7241	19.9393	20.2383	20.4186	20.4712	20.4741	20.4753	20.4520	20.2147	19.8553	19.5672	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5809	19.7241	19.9393	20.2383	20.4186	20.4712	20.4741	20.4753	20.4520	20.2147	19.8553	19.5672	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9964	0.9887	0.9456	0.8069	0.5697	0.3962	0.4464	0.7400	0.9683	0.9962	0.9990	(94)
Useful gains	501.9729	563.5224	607.5028	645.0867	583.5976	409.0271	271.2532	284.3353	433.3056	503.7480	486.6227	482.6191	(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	1111.5491	1075.2460	972.0144	808.3085	619.7437	411.2533	271.3676	284.6129	447.5666	683.4401	911.9708	1105.0829	(97)
Space heating kWh	453.5246	343.8783	271.1966	117.5197	26.8926	0.0000	0.0000	0.0000	0.0000	133.6909	306.2506	463.1131	(98a)
Space heating requirement - total per year (kWh/year)												2116.0665	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	453.5246	343.8783	271.1966	117.5197	26.8926	0.0000	0.0000	0.0000	0.0000	133.6909	306.2506	463.1131	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2116.0665	
Space heating per m2											(98c) / (4) =	30.3161	(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	453.5246	343.8783	271.1966	117.5197	26.8926	0.0000	0.0000	0.0000	0.0000	133.6909	306.2506	463.1131	(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)	453.5246	343.8783	271.1966	117.5197	26.8926	0.0000	0.0000	0.0000	0.0000	133.6909	306.2506	463.1131	(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	226.6304	200.0454	211.5548	183.6806	176.4802	157.3103	154.0002	161.0669	163.8893	184.8048	199.0220	223.8492	(64)
Efficiency of water heater												344.4397	(216)
(217)m	344.4397	344.4397	344.4397	344.4397	344.4397	344.4397	344.4397	344.4397	344.4397	344.4397	344.4397	344.4397	(217)
Fuel for water heating, kWh/month	65.7968	58.0785	61.4200	53.3274	51.2369	45.6714	44.7104	46.7620	47.5814	53.6537	57.7814	64.9894	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.4687	16.6814	18.4687	17.8730	18.4687	17.8730	18.4687	18.4687	17.8730	18.4687	17.8730	18.4687	(231)
Lighting	21.2451	17.0436	15.3459	11.2430	8.6844	7.0953	7.9222	10.2976	13.3756	17.5495	19.8221	21.8355	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.0704	-17.5009	-27.9153	-33.9151	-37.9560	-35.7757	-35.3139	-31.9231	-26.4150	-20.7728	-12.7285	-9.3636	(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												2116.0665	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	344.4397	
Water heating fuel used	651.0092	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)		
mechanical ventilation fans (SFP = 1.0640)	217.4544	(230a)
Total electricity for the above, kWh/year	217.4544	(231)
Electricity for lighting (calculated in Appendix L)	171.4598	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-300.6502	(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	2855.3398	(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	2116.0665	0.1563	330.7065	(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)	651.0092	0.1412	91.9046	(264)
Space and water heating			422.6112	(265)
Pumps, fans and electric keep-hot	217.4544	0.1387	30.1636	(267)
Energy for lighting	171.4598	0.1443	24.7470	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-300.6502	0.1331	-40.0200	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-40.0200	(269)
Total CO2, kg/year			437.5017	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.2700	(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	2116.0665	1.5786	3340.4184	(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)	651.0092	1.5220	990.8480	(278)
Space and water heating			4331.2664	(279)
Pumps, fans and electric keep-hot	217.4544	1.5128	328.9650	(281)
Energy for lighting	171.4598	1.5338	262.9908	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-300.6502	1.4919	-448.5360	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-448.5360	(283)
Total Primary energy kWh/year			4474.6863	(286)
Dwelling Primary energy Rate (DPER)			64.1100	(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	69.8000	(1b)	x 2.4000	(2b) =	167.5200	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		167.5200	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	2 * 10 = 20.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1194	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)

Infiltration rate												0.3694	(18)
Number of sides sheltered												0	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				1.0000	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.3694	(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													
	0.4710	0.4617	0.4525	0.4063	0.3971	0.3509	0.3509	0.3417	0.3694	0.3971	0.4156	0.4340	(22b)
Effective ac	0.6109	0.6066	0.6024	0.5826	0.5788	0.5616	0.5616	0.5584	0.5682	0.5788	0.5863	0.5942	(25)

---

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			1.9800	1.0000	1.9800			(26)
TER Opening Type			8.4900	1.1450	9.7214			(27)
Heatloss Floor 1			69.8000	0.1300	9.0740			(28a)
External Wall	69.0200	10.4700	58.5500	0.1800	10.5390			(29a)
Riser Wall	29.6600		29.6600	0.1800	5.3388			(29a)
External Roof 1	69.8000		69.8000	0.1100	7.6780			(30)
Total net area of external elements Aum(A, m2)			238.2800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.3312			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	371.3016	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	14.9400	0.0600	0.8964
P1 Party wall - Ground floor	0.0000	0.0800	0.0000
P4 Party wall - Roof (insulation at ceiling level)	0.0000	0.1200	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.0000	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	7.2700	0.0500	0.3635
E4 Jamb	17.3000	0.0500	0.8650
E3 Sill	4.7700	0.0500	0.2385
E16 Corner (normal)	16.8000	0.0900	1.5120
E17 Corner (inverted - internal area greater than external area)	7.2000	-0.0900	-0.6480
E18 Party wall between dwellings	0.0000	0.0600	0.0000
E5 Ground floor (normal)	0.0000	0.1600	0.0000
E12 Gable (insulation at ceiling level)	13.8200	0.0600	0.8292
E7 Party floor between dwellings (in blocks of flats)	39.0200	0.0700	2.7314
E14 Flat roof	12.3600	0.0800	0.9888
E20 Exposed floor (normal)	0.0000	0.3200	0.0000
E23 Balcony within or between dwellings, balcony support penetrates wall insulation	2.1000	0.0200	0.0420

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.8188	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	52.1500	(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	33.7719	33.5338	33.3005	32.2044	31.9993	31.0446	31.0446	30.8678	31.4123	31.9993	32.4141	32.8479	(38)
Heat transfer coeff													
	85.9219	85.6838	85.4504	84.3543	84.1493	83.1946	83.1946	83.0178	83.5623	84.1493	84.5641	84.9978	(39)
Average = Sum(39)m / 12 =												84.3533	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2310	1.2276	1.2242	1.2085	1.2056	1.1919	1.1919	1.1894	1.1972	1.2056	1.2115	1.2177	(40)
HLP (average)												1.2085	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2413	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
61.7982	60.8695	59.5162	56.9269	55.0160	52.8851	51.6738	53.0169	54.4891	56.7771	59.4221	61.5614	(42a)

Hot water usage for baths

26.6985	26.3020	25.7436	24.7141	23.9432	23.0884	22.6266	23.1811	23.7848	24.6995	25.7502	26.6082	(42b)

Hot water usage for other uses

37.5827	36.2161	34.8494	33.4828	32.1162	30.7495	30.7495	32.1162	33.4828	34.8494	36.2161	37.5827	(42c)

Average daily hot water use (litres/day)	115.8957	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	126.0794	123.3875	120.1092	115.1237	111.0753	106.7229	105.0500	108.3141	111.7568	116.3261	121.3884	125.7524	(44)
Energy conte	199.6790	175.7022	184.6034	157.5986	149.5288	131.2283	127.0488	134.1155	137.8073	157.8534	172.9400	196.8978	(45)
Energy content (annual)										Total = Sum(45)m =		1925.0032	
Distribution loss (46)m = 0.15 x (45)m													
	29.9518	26.3553	27.6905	23.6398	22.4293	19.6842	19.0573	20.1173	20.6711	23.6780	25.9410	29.5347	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	246.2739	217.7879	231.1983	202.6905	196.1237	176.3201	173.6437	180.7104	182.8991	204.4483	218.0318	243.4927	(62)
WWHRS	-28.2516	-24.9859	-26.1638	-21.6647	-20.1907	-17.2773	-16.1947	-17.2215	-17.8758	-21.0736	-23.8738	-27.7284	(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													
	218.0223	192.8020	205.0345	181.0258	175.9330	159.0428	157.4490	163.4890	165.0233	183.3747	194.1580	215.7644	(64)
										Total per year (kWh/year) = Sum(64)m =		2211.1189	(64)
12Total per year (kWh/year)												2211	(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

	103.6692	92.0896	98.6566	88.4750	86.9942	79.7069	79.5197	81.8693	81.8944	89.7622	93.5760	102.7445 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	112.0630	(66)

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

	109.8656	121.6369	109.8656	113.5278	109.8656	113.5278	109.8656	109.8656	113.5278	109.8656	113.5278	109.8656	(67)

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

	196.8298	198.8723	193.7253	182.7680	168.9364	155.9366	147.2520	145.2095	150.3565	161.3138	175.1454	188.1452	(68)

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

	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	34.2063	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	-89.6504	(71)

Water heating gains (Table 5)

	139.3403	137.0380	132.6029	122.8820	116.9277	110.7040	106.8813	110.0394	113.7422	120.6481	129.9667	138.0974	(72)

Total internal gains

	505.6546	517.1661	495.8127	478.7967	455.3486	436.7873	420.6177	421.7334	434.2453	451.4463	478.2587	495.7270	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1600	10.6334	0.6300	0.7000	0.7700	7.0194	(74)
East	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(76)

Solar gains	45.0140	87.7400	145.1980	215.1321	268.1029	276.7618	262.5163	222.2632	169.7668	104.1617	56.0342	37.0967	(83)
Total gains	550.6686	604.9061	641.0107	693.9287	723.4515	713.5491	683.1340	643.9966	604.0121	555.6080	534.2929	532.8237	(84)

---

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.7869	84.0197	84.2491	85.3439	85.5519	86.5336	86.5336	86.7179	86.1528	85.5519	85.1321	84.6977	
alpha	6.5858	6.6013	6.6166	6.6896	6.7035	6.7689	6.7689	6.7812	6.7435	6.7035	6.6755	6.6465	
util living area	0.9989	0.9976	0.9938	0.9745	0.9017	0.7171	0.5322	0.5859	0.8497	0.9821	0.9972	0.9991	(86)
MIT	20.0282	20.1473	20.3382	20.6205	20.8565	20.9771	20.9972	20.9950	20.9301	20.6369	20.2924	20.0146	(87)
Th 2	19.8953	19.8980	19.9007	19.9132	19.9155	19.9265	19.9265	19.9285	19.9223	19.9155	19.9108	19.9058	(88)
util rest of house	0.9983	0.9963	0.9904	0.9598	0.8496	0.6114	0.4046	0.4537	0.7607	0.9688	0.9955	0.9987	(89)
MIT 2	18.7816	18.9359	19.1810	19.5415	19.8071	19.9168	19.9260	19.9274	19.8839	19.5682	19.1316	18.7724	(90)
Living area fraction									fLA = Living area / (4) =			0.4284	(91)
MIT	19.3156	19.4548	19.6767	20.0037	20.2566	20.3710	20.3849	20.3847	20.3321	20.0260	19.6289	19.3045	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3156	19.4548	19.6767	20.0037	20.2566	20.3710	20.3849	20.3847	20.3321	20.0260	19.6289	19.3045	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9956	0.9895	0.9613	0.8681	0.6571	0.4596	0.5109	0.7982	0.9706	0.9948	0.9983	(94)
Useful gains	549.5079	602.2699	634.2774	667.0738	628.0417	468.8484	313.9805	329.0366	482.1000	539.2512	531.5353	531.9206	(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	1290.1680	1247.1092	1125.9552	936.6465	720.0338	480.1143	314.8801	330.8028	520.7684	793.1933	1059.4913	1283.8535	(97)
Space heating kWh	551.0511	433.3321	365.8083	194.0923	68.4421	0.0000	0.0000	0.0000	0.0000	188.9329	380.1283	559.4380	(98a)
Space heating requirement - total per year (kWh/year)												2741.2252	
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	551.0511	433.3321	365.8083	194.0923	68.4421	0.0000	0.0000	0.0000	0.0000	188.9329	380.1283	559.4380	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2741.2252	
Space heating per m2											(98c) / (4) =	39.2726	(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	551.0511	433.3321	365.8083	194.0923	68.4421	0.0000	0.0000	0.0000	0.0000	188.9329	380.1283	559.4380	(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)	597.0218	469.4822	396.3254	210.2842	74.1518	0.0000	0.0000	0.0000	0.0000	204.6944	411.8400	606.1084	(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

	218.0223	192.8020	205.0345	181.0258	175.9330	159.0428	157.4490	163.4890	165.0233	183.3747	194.1580	215.7644 (64)
Efficiency of water heater												79.8000 (216)
(217)m	86.0488	85.8196	85.3429	84.2164	82.1313	79.8000	79.8000	79.8000	79.8000	84.1268	85.5384	86.0973 (217)
Fuel for water heating, kWh/month												
	253.3705	224.6596	240.2480	214.9532	214.2093	199.3018	197.3045	204.8734	206.7961	217.9741	226.9834	250.6052 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	22.8279	18.3134	16.4892	12.0807	9.3315	7.6239	8.5125	11.0648	14.3721	18.8570	21.2989	23.4624 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-32.8340	-46.3737	-66.7744	-75.2168	-81.2322	-75.8820	-74.9729	-70.7437	-63.2581	-53.1303	-36.1393	-28.3794 (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	-18.2665	-38.4697	-76.5387	-115.0590	-152.2259	-152.9689	-151.1403	-127.8994	-93.6728	-55.0135	-24.3898	-14.4387 (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	2969.9082 (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	2651.2792 (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)	184.2342 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1725.0200 (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	4166.4016 (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	2969.9082	0.2100	623.6807	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2651.2792	0.2100	556.7686	(264)
Space and water heating			1180.4494	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	184.2342	0.1443	26.5907	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-704.9367	0.1345	-94.8441	
PV Unit electricity exported	-1020.0833	0.1259	-128.4014	
Total			-223.2454	(269)
Total CO2, kg/year			995.7239	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.2700	(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	2969.9082	1.1300	3355.9962	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2651.2792	1.1300	2995.9455	(278)
Space and water heating			6351.9418	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	184.2342	1.5338	282.5846	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-704.9367	1.4972	-1055.4627	
PV Unit electricity exported	-1020.0833	0.4620	-471.3205	
Total			-1526.7832	(283)
Total Primary energy kWh/year			5237.8439	(286)
Target Primary Energy Rate (TPER)			75.0400	(287)

Contact details:

Whitecode Consulting Ltd
26-27 The Hill
Northfleet Gravesend
Kent
DA11 9EU

t: 01322 289977
f: 01322 289988

e: design@whitecode.co.uk