



WHITECODE
CONSULTING

Energy Strategy

Huggens College, Northfleet

Prepared for The President and Trustees of Huggens's' College

12135-WCL-ZZ-ZZ-RP-Y-0001

Rev 01

March 2024

Executive Summary

This energy strategy has been prepared by Whitecode Consulting to accompany an application for planning permission for the development at Huggens College. The planning application is submitted on behalf of Henry Riley. It is completed inline with energy requirements for the site and the Gravesham Local Plan Core Strategy (September 2014).

The site description is as follows:

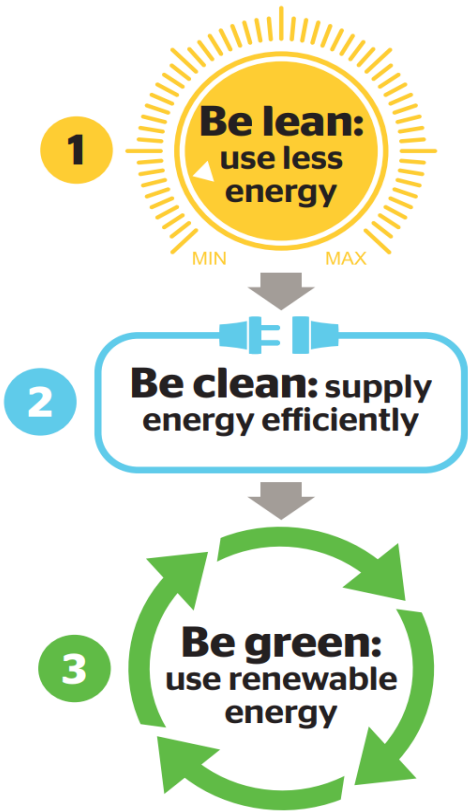
Demolition of existing buildings and erection of retirement living apartments (Use Class C3), together with the extension of the existing chapel and the provision of associated communal facilities and external amenity space, lodge keeper's and guest accommodation, back-of-house facilities, parking, bicycle/mobility scooter parking, and associated works including the creation of a secondary, emergency access from College Road.

The residential elements have been assessed against Part L1A 2021 of the Building Regulations using the Standard Assessment Procedure (SAP) 10.2 methodology. The non-residential elements have been assessed under Part L2A 2021 of the Building Regulations using DSM methodology and IES software. 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 **residential** development will achieve a 70% improvement over Part L 2021 of the Building Regulations and the **communal space** in the development will achieve 7% improvement.

Overall, the proposed development will achieve a 67% improvement over Part L 2021 of the Building Regulations (site-wide).



- **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** – Highly efficient exhaust air source heat pumps are to be installed

This report concludes that the proposed development will achieve a **67% improvement** over Part L 2021 of the Building Regulations.

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

	Carbon dioxide emissions for domestic buildings (tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021	67.3
After energy demand reduction (be lean)	62.2
After heat network/CHP (be clean)	62.2
After renewable energy (be green)	20.1

Table 1: Carbon emissions after each stage of the energy hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	5.2	8%
Be clean: savings from heat network/CHP	0	0%
Be green: savings from renewable energy	42.1	63%
Cumulative on-site savings	47.3	70%

Table 2: Regulated carbons savings after each stage of the energy hierarchy for domestic buildings

	Carbon dioxide emissions for non-domestic buildings (tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021	3.5
After energy demand reduction (be lean)	3.4
After heat network/CHP (be clean)	3.4
After renewable energy (be green)	3.3

Table 3: Carbon emissions after each stage of the energy hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.1	2%
Be clean: savings from heat network/CHP	0	0%
Be green: savings from renewable energy	0.2	5%
Cumulative on-site savings	0.3	7%

Table 4: Regulated carbon savings after each stage of the energy hierarchy for non-domestic buildings

	Total regulated emissions (tonnes CO ₂ /year)	CO ₂ /year (tonnes CO ₂ /year)	Percentage saving (%)
Part L 2021 baseline	70.8		
Be lean	65.6	5.2	7%
Be clean	65.6	0	0%
Be green	23.3	42.3	60%
Total savings		47.5	67%

Table 5: Site wide carbon savings

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Revisions:

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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 Huggens College, Northfleet. 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 (CO₂) emissions than a notional equivalent of given specifications.

The National Planning Policy Framework (NPPF) was updated in December 2023, 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 and sets out key principles that regional planning bodies and local planning authorities should adhere to in their approach to planning for renewable energy.

1.2. Local Planning Policies

The proposed development lies in the borough of Gravesham, therefore, the applicable Local Planning Policy is the Gravesham Local Plan Core Strategy, adopted September 2014.

This sets out long term energy and sustainability related standards for the Borough. The planning policies of relevance to energy and sustainability in the Local Plan are as follows:

- Policy CS01: Sustainable Development
- Policy CS03: Northfleet Embankment and Swanscombe Peninsula East Opportunity Area
- Policy CS11: Transport
- Policy CS12: Green Infrastructure

- Policy CS18: Climate change

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.

The other policies that set out the sustainability standards are explored in our separate sustainability statement.

1.3. The Development

The development consists of the demolition of existing buildings and erection of retirement living apartments (Use Class C3), together with the extension of the existing chapel and the provision of associated communal facilities and external amenity space, lodge keeper's and guest accommodation, back-of-house facilities, parking, bicycle/mobility scooter parking, and associated works including the creation of a secondary, emergency access from College Road.

This report covers the 96 dwellings and shared communal facilities for the residents as well as the guest suites and lodge keepers accommodation.

A sample of dwellings have been modelled using the Standard Assessment Procedure (SAP) 10.2 methodology.

The communal amenity spaces within the block have been assessed. These are shown in Figure 1.1 and were modelled against L2A 2021 (DSM) using IES Virtual Environment (v2023).

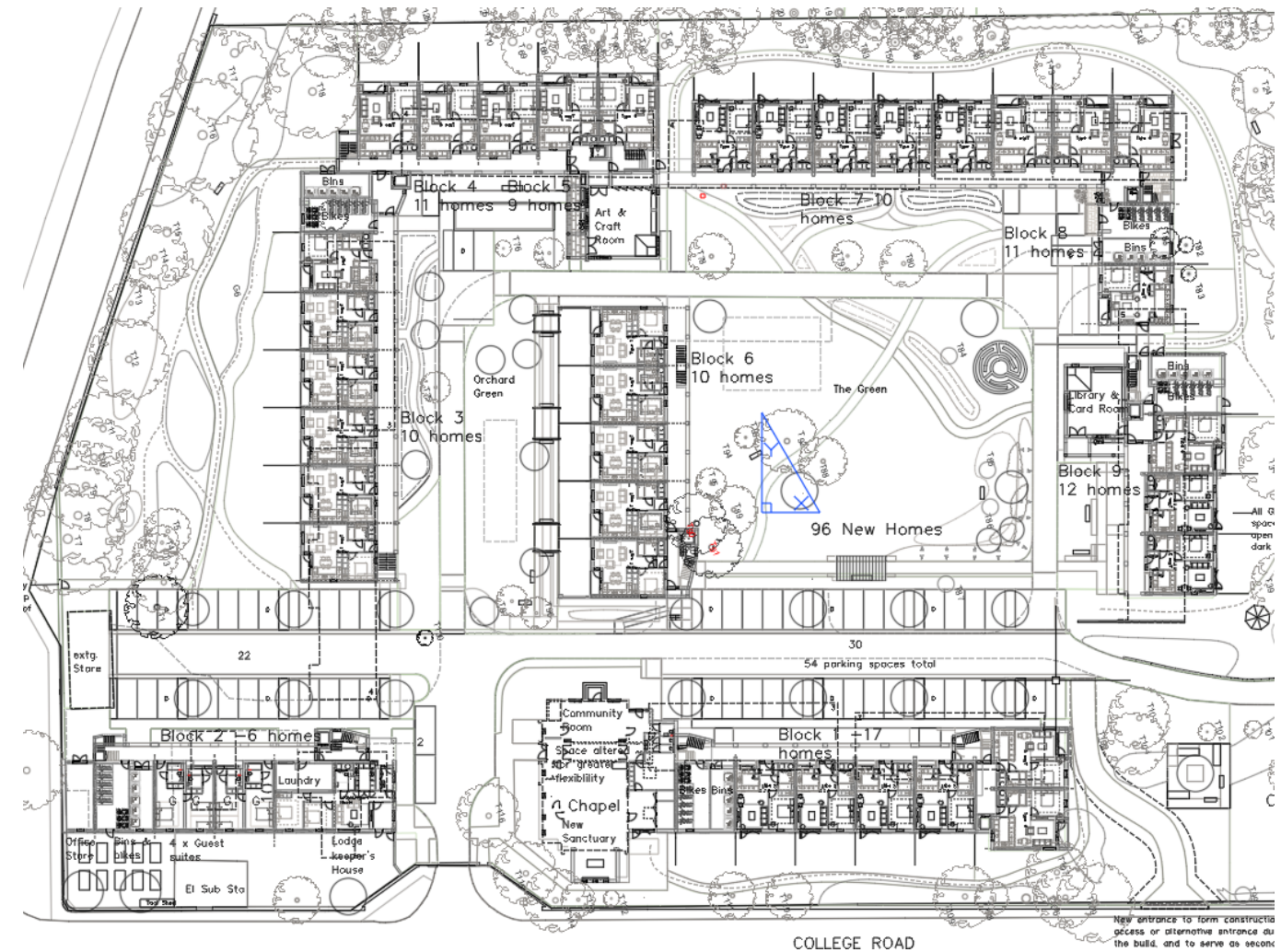


Figure 1.1 Proposed Site Plan

2. Baseline Energy Consumption & Carbon Emissions

An assessment of the sites 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 CO2 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: a Dwelling CO₂ Emissions Rate (DER) has been calculated through the Part L 2021 of the Building Regulations methodology SAP 10.2. A representative sample of dwellings have been selected to model covering all unit types, orientations and floor levels.

Non-residential: a Building CO₂ Emissions Rate (BER) has been calculated through the Part L 2021 of the Building Regulations methodology based on the National Calculation Methodology (NCM) and implemented through Dynamic Simulation Model (DSM) v7.0.21

To determine the CO₂ emissions baseline, the Target Emission Rate (TER) from the Be Lean model is used.

Regulated carbon dioxide emissions (tonnes CO ₂ per annum)	Domestic	Non-domestic
Baseline: Part L 2013 of the Building Regulations compliant development	67.3	3.5

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/m ²
Part L1A Target Fabric Energy Efficiency Rate (TFEE)	28.11

Table 2.2 Target fabric energy efficiency

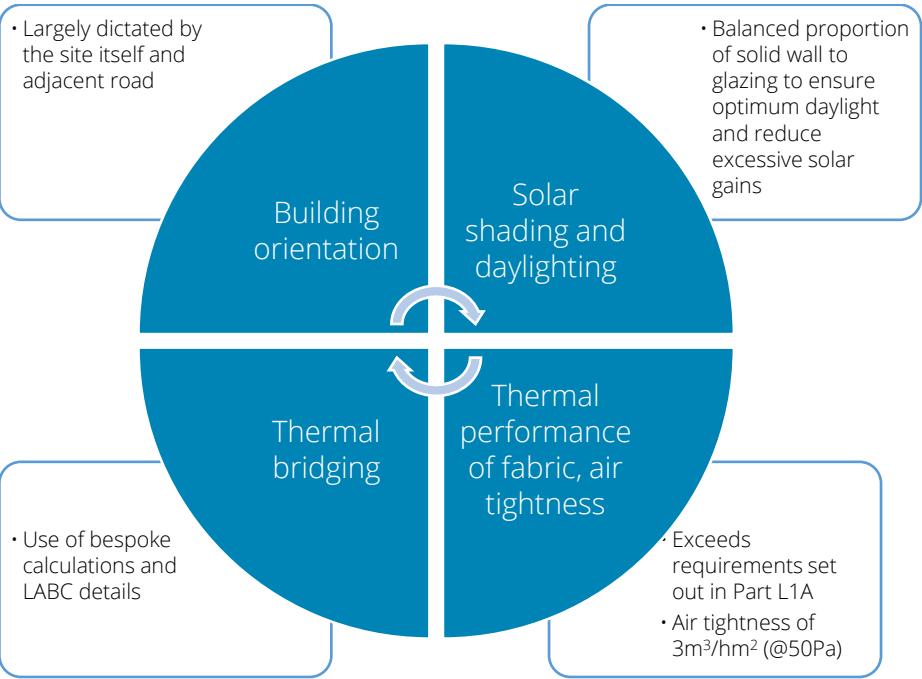
3. 'Be Lean' – Energy efficient design

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

Local planning guidelines require a reduction in the CO2 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 2013 Limiting Values:	Domestic design	Non-domestic design
Floors	0.25 W/m²K	0.10 W/m²K	0.10 W/m²K
External Walls	0.30 W/m²K	0.15 W/m²K	0.15 W/m²K
Common Area Walls (unheated space)	0.30 W/m²K	0.20 W/m²K	N/A
Party Walls (between dwellings)	0.20 W/m²K	0.00 W/m²K	N/A
Roofs	0.20 W/m²K	0.10 W/m²K	0.10 W/m²K
Front Doors	2.00 W/m²K	1.20 W/m²K	1.20 W/m²K
Windows	2.00 W/m²K	1.20 W/m²K	1.20 W/m²K
Window g-value	N/A	0.43	0.40
Air Permeability Rate	10m³/hm² (@50Pa)	3 m³/hm² (@50Pa)	3m³/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 buildings services, lighting, and controls throughout the scheme to reduce fuel consumption.

3.3. 'Be Lean' Results

A sample of SAP calculations have been carried out for the proposed development using the 'Be Lean' specification. A Dynamic Simulation Model (DSM) for the non-domestic parts have also been completed. Using the notional building system type and performance values specified in the Part L 2021 baseline as determined by the final proposed building specification.

Regulated carbon dioxide emissions (tonnes CO ₂ per annum)	Domestic tonnes CO ₂ per annum	Non-domestic tonnes CO ₂ per annum
Baseline: Part L 2021 of the Building Regulations compliant development	67.3	3.5
After energy demand reduction (be lean)	62.2	3.4
Carbon savings over baseline	5.2	0.1
Carbon reduction over baseline	8%	8%

The reduction in fabric energy efficiency is 6% as the following table demonstrates:

Fabric energy efficiency	(kWh/m ² per annum)
Part L1A Target Fabric Energy Efficiency Rate (TFEE)	28.11
Dwelling Fabric Efficiency (DFEE)	25.77
Reduction over TFEE	8%

Table 3.2 Fabric energy efficiency

Space heating and hot water

- Exhaust air Source Heat Pumps (EAHP) will provide heating, ventilation and hot water to the individual dwellings
- Non-domestic spaces will be an air to water heat pump, such as the Mitsubishi Electric Model CAHV-R45YA-HPB for heating and instantaneous hot water



Ventilation

- The dwellings will be provided with mechanical ventilation with heat recovery as part of the EAHP, this removes stale air from wet areas creating a permanent air path through the property through habitable rooms. The air drawn into the dwelling is routed through a high efficiency heat exchanger where warmth from the extracted air is transferred to the incoming fresh air before being supplied to habitable rooms. This lowers the heating requirements of the dwelling.
- Non-domestic spaces are naturally ventilated

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 CO₂ 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 = 80)
- Non-domestic lighting minimum 100lm/cW efficiency
- Occupancy controls - Auto-On-Off for stores and WCs in amenity spaces

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. Louvres for ventilation have been added to the dwelling so that 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.

A separate overheating report has been completed against TM59 and Part O of the Building Regulations which investigates the performance of the current design and the recommendations for full compliance.

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.

Due to the lack of an available network nearby connection to an existing district heating network was deemed unfeasible.

Instead of this, highly efficient Air Source Heat Pumps (ASHPs) are proposed for the heating and hot water for the building. This is explored in the 'Be Green' section.

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.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	
	Domestic	Non-domestic
Baseline: Part L 2021 of the Building Regulations compliant development	67.3	3.5
After energy demand reduction (be lean)	62.2	3.4
After heat network/CHP (be clean)	62.2	3.4
% reduction at this stage	0	0

6. 'Be Green' – Renewable Energy

6.1. Heat Pumps

Exhaust Air Heat Pumps (EAHP) have been identified as the most appropriate technology, to provide the heating and hot water for the residential dwellings.

The individual EAHPs proposed are the Nilan Compact P. These are an energy efficient total indoor climate solution for all types of low energy dwellings. They recover energy from the extracted air using a highly efficient counter flow heat exchanger, the remaining energy that is not utilised by the counter flow heat exchanger is used by the heat pump to produce hot water and to further heat the supply air.

The heat pump has a reversible cooling circuit which is able to cool the supply air by up to 10°C, which will assist with any units which have an overheating issue under TM59. This air is also dehumidified which provides a pleasant indoor climate for the occupant.

The units have been designed to ensure there are minimal heat losses through a fabric first approach and low air permeability target. The heating load is therefore minimised, resulting in lower bills for the occupants.

The table below shows the performance of the EAHP, taken from the datasheets.

	Nilan Compact P
Seasonal Coefficient of Performance (SCOP)	4.97

The non-domestic spaces will be an air to water heat pump, such as the Mitsubishi Electric Model CAHV-R45YA-HPB for heating and direct electric for hot water.

6.2. 'Be Green' Results

A sample of SAP calculations for the dwellings and DSM for the non-domestic areas have been completed using the 'Be Green' specification of exhaust air source heat pumps to the dwellings.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	
	Domestic	Non-domestic
Baseline: Part L 2021 of the Building Regulations compliant development	67.3	3.5
After energy demand reduction (be lean)	62.2	3.4
After heat network/CHP (be clean)	62.2	3.4
After renewable energy (be green)	20.1	3.3
% carbon reduction	70%	7%
% carbon reduction site wide	67%	

Table 6.1 Sitewide carbon savings

The same building fabric specification has been assumed as per the 'Be Lean' section of the energy hierarchy. When ASHP are added to the design, there has been a 60% carbon reduction compared to baseline (site wide).

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

7. 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 and L2A, as well as the Gravesham Local Plan.

The strategy for reducing energy and associated carbon emission 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 not been deemed either available or appropriate at this time.
- **Be Green** – Highly efficient exhaust air source heat pumps are to be installed to service the residential dwellings

This report concludes that the proposed development at Huggens College, will achieve a **67%** improvement over Part L1A 2021 of the Building Regulations.

The final specification to meet the 61% carbon reduction on site is as follows:

	Specification	
	Domestic	Non- domestic
Heating	Exhaust air heat pump	Air source heat pump
Hot water	Exhaust air heat pump	Instantaneous
Emitter	Air	VRF split system
Cooling	N/A	N/A
Ventilation	Exhaust air heat pump	Natural ventilation
Lighting	100% low energy 80lm/cW	100lm/cW
Lighting controls (daylighting)	N/A	N/A
Lighting controls (occupancy)	N/A	Auto On-Off WC and store

Table 7.1 Summary of specification to meet the building regulations

	Carbon dioxide emissions for domestic buildings (tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021	67.3
After energy demand reduction (be lean)	62.2
After heat network/CHP (be clean)	62.2
After renewable energy (be green)	20.1

Table 7.2: Carbon emissions after each stage of the energy hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	5.2	8%
Be clean: savings from heat network/CHP	0	0%
Be green: savings from renewable energy	42.1	63%
Cumulative on-site savings	47.3	70%

Table 7.3: Regulated carbons savings after each stage of the energy hierarchy for domestic buildings

	Carbon dioxide emissions for non-domestic buildings (tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021	3.5
After energy demand reduction (be lean)	3.4
After heat network/CHP (be clean)	3.4
After renewable energy (be green)	3.3

Table 7.4: Carbon emissions after each stage of the energy hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.1	2%
Be clean: savings from heat network/CHP	0	0%
Be green: savings from renewable energy	0.2	5%
Cumulative on-site savings	0.3	7%

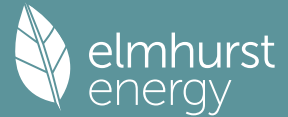
Table 7.5: Regulated carbon savings after each stage of the energy hierarchy for non-domestic buildings

	Total regulated emissions (tonnes CO ₂ /year)	CO ₂ /year (tonnes CO ₂ /year)	Percentage saving (%)
Part L 2021 baseline	70.8		
Be lean	65.6	5.2	7%
Be clean	65.6	0	0%
Be green	23.3	42.3	60%
Total savings		47.5	67%

Table 7.6: Site wide carbon savings

Appendix A – SAP Outputs

Full SAP Calculation Printout



Property Reference	Type 2 end East mid floor				Issued on Date	15/04/2024	
Assessment Reference	Type 2 end East Be Lean			Prop Type Ref			
Property							
SAP Rating	84 B	DER	13.73	TER	12.55		
Environmental	90 B	% DER < TER				-9.40	
CO ₂ Emissions (t/year)	0.72	DFEE	24.74	TFEE	27.13		
Compliance Check	See BREL	% DFEE < TFEE				8.82	
% DPER < TPER	-19.10	DPER	78.79	TPER	66.16		
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.4500 (1b)	2.4000 (2b)	133.0800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.0800 (5)

2. Ventilation rate

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

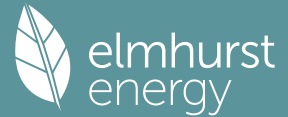
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												75.2000 (23c)
Effective ac	0.2866	0.2834	0.2802	0.2642	0.2611	0.2451	0.2451	0.2419	0.2515	0.2611	0.2674	0.2738 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			11.1000	1.1450	12.7099		(27)
Door			1.9700	1.2000	2.3640		(26a)
External Wall 1	54.8300	13.0700	41.7600	0.1500	6.2640	110.0000	4593.6000 (29a)
Total net area of external elements Aum(A, m ²)			54.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.3379		(33)
Party Wall 1			17.9900	0.0000	0.0000	110.0000	1978.9000 (32)
Party Floor 1			55.4500			30.0000	1663.5000 (32a)
Party Ceiling 1			55.4500			30.0000	1663.5000 (32b)
Internal Wall 1			112.6100			75.0000	8445.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18345.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							330.8431 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.5000	0.1500	0.9750	

Full SAP Calculation Printout



E3 Sill	2.2100	0.0400	0.0884
E4 Jamb	17.3000	0.0500	0.8650
E7 Party floor between dwellings (in blocks of flats)	45.6800	0.0300	1.3704
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0300	-0.0720
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	15.0000	0.0000	0.0000
E16 Corner (normal)	7.5000	0.0900	0.6750
E18 Party wall between dwellings	2.4000	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.9018 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	25.2397 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	12.5848	12.4448	12.3048	11.6049	11.4649	10.7650	10.7650	10.6250	11.0450	11.4649	11.7449	12.0249
Average = Sum(39)m / 12 =	37.8245	37.6845	37.5445	36.8446	36.7046	36.0047	36.0047	35.8647	36.2847	36.7046	36.9846	37.2646
												36.8096
HLP	0.6821	0.6796	0.6771	0.6645	0.6619	0.6493	0.6493	0.6468	0.6544	0.6619	0.6670	0.6720
HLP (average)												0.6638
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8505 (42)
Hot water usage for mixer showers												
	55.2469	54.4166	53.2068	50.8920	49.1837	47.2786	46.1958	47.3965	48.7127	50.7581	53.1226	55.0352
Hot water usage for baths												
	25.1381	24.7648	24.2390	23.2697	22.5438	21.7390	21.3042	21.8263	22.3947	23.2559	24.2453	25.0531
Hot water usage for other uses												
	35.3487	34.0633	32.7779	31.4925	30.2071	28.9217	28.9217	30.2071	31.4925	32.7779	34.0633	35.3487
Average daily hot water use (litres/day)												106.3780
												(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	115.7337	113.2447	110.2237	105.6541	101.9346	97.9393	96.4217	99.4299	102.5999	106.7920	111.4312	115.4371
Energy conte	183.2939	161.2590	169.4098	144.6352	137.2236	120.4278	116.6137	123.1150	126.5159	144.9157	158.7542	180.7465
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	27.4941	24.1888	25.4115	21.6953	20.5835	18.0642	17.4921	18.4672	18.9774	21.7374	23.8131	27.1120
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.2988	49.1355	50.6684	49.3151	50.9589	49.3151	50.9589
Total heat required for water heating calculated for each month												
	234.2528	207.2864	220.3687	193.9503	188.1825	168.7266	165.7492	173.7833	175.8310	195.8746	208.0693	231.7054
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h												
	234.2528	207.2864	220.3687	193.9503	188.1825	168.7266	165.7492	173.7833	175.8310	195.8746	208.0693	231.7054
12Total per year (kWh/year)												
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month												
	73.6849	65.1255	69.0685	60.4200	58.3666	52.1170	51.0579	53.6028	54.3953	60.9242	65.1145	72.8379
												(65)

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

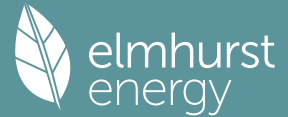
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	81.3798	90.0991	81.3798	84.0925	81.3798	84.0925	81.3798	81.3798	84.0925	81.3798	84.0925	81.3798
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	161.3446	163.0188	158.7997	149.8179	138.4799	127.8237	120.7048	119.0305	123.2496	132.2315	143.5695	154.2256
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
Losses e.g. evaporation (negative values) (Table 5)												
	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213
Water heating gains (Table 5)												
	99.0389	96.9129	92.8340	83.9166	78.4497	72.3847	68.6262	72.0468	75.5490	81.8874	90.4369	97.9005
Total internal gains												
	395.5212	403.7887	386.7715	371.5849	352.0673	335.0588	321.4688	323.2151	333.6491	349.2566	371.8568	387.2638
												(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
East		3.0200	19.6403	0.4300	0.8000	0.7700	14.1399
West		8.0800	19.6403	0.4300	0.8000	0.7700	37.8312
Solar gains	51.9711	101.6665	167.4303	244.1871	299.2604	306.3463	291.6541
Total gains	447.4923	505.4552	554.2018	615.7720	651.3277	641.4051	613.1230
							250.5266
							194.7283
							120.6359
							64.8019
							42.7385
							430.0024
							(84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	134.7249	135.2253	135.7295	138.3079	138.8354	141.5343	141.5343	142.0867	140.4422	138.8354	137.7844	136.7492	
alpha	9.9817	10.0150	10.0486	10.2205	10.2557	10.4356	10.4356	10.4724	10.3628	10.2557	10.1856	10.1166	
util living area	0.9904	0.9691	0.9012	0.7164	0.5238	0.3593	0.2584	0.2875	0.4737	0.7923	0.9660	0.9929 (86)	
MIT	20.6887	20.8068	20.9257	20.9923	20.9996	21.0000	21.0000	21.0000	20.9999	20.9844	20.8472	20.6706 (87)	
Th 2	20.3566	20.3589	20.3611	20.3723	20.3746	20.3858	20.3858	20.3881	20.3813	20.3746	20.3701	20.3656 (88)	
util rest of house	0.9871	0.9596	0.8783	0.6818	0.4887	0.3248	0.2223	0.2493	0.4313	0.7516	0.9540	0.9903 (89)	
MIT 2	20.0056	20.1521	20.2897	20.3662	20.3743	20.3858	20.3858	20.3881	20.3813	20.3627	20.2124	19.9908 (90)	
Living area fraction									fLA = Living area / (4) =				0.4537 (91)
MIT	20.3156	20.4492	20.5783	20.6503	20.6581	20.6645	20.6645	20.6657	20.6620	20.6448	20.5004	20.2993 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	20.1656	20.2992	20.4283	20.5003	20.5081	20.5145	20.5145	20.5157	20.5120	20.4948	20.3504	20.1493 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9858	0.9586	0.8809	0.6889	0.4962	0.3320	0.2299	0.2573	0.4403	0.7597	0.9536	0.9892 (94)
Useful gains	441.1577	484.5331	488.1740	424.2245	323.1735	212.9483	140.9404	147.6094	232.6299	356.9670	416.3916	425.3766 (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	600.1070	580.3109	522.9306	427.4084	323.2971	212.9497	140.9404	147.6095	232.6564	363.1843	490.0627	594.3424 (97)
Space heating kWh	118.2583	64.3627	25.8590	2.2924	0.0920	0.0000	0.0000	0.0000	0.0000	4.6257	53.0432	125.7105 (98a)
Space heating requirement - total per year (kWh/year)												394.2437
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	118.2583	64.3627	25.8590	2.2924	0.0920	0.0000	0.0000	0.0000	0.0000	4.6257	53.0432	125.7105 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												394.2437
Space heating per m2										(98c) / (4) =		7.1099 (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 %)												88.1000 (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	118.2583	64.3627	25.8590	2.2924	0.0920	0.0000	0.0000	0.0000	0.0000	4.6257	53.0432	125.7105 (98)
Space heating efficiency (main heating system 1)	88.1000	88.1000	88.1000	88.1000	88.1000	0.0000	0.0000	0.0000	0.0000	88.1000	88.1000	88.1000 (210)
Space heating fuel (main heating system)	134.2319	73.0564	29.3518	2.6021	0.1044	0.0000	0.0000	0.0000	0.0000	5.2505	60.2079	142.6907 (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	234.2528	207.2864	220.3687	193.9503	188.1825	168.7266	165.7492	173.7833	175.8310	195.8746	208.0693	231.7054 (64)
Efficiency of water heater (217)m	82.1916	81.3823	80.3235	79.5908	79.5038	79.5000	79.5000	79.5000	79.5000	79.6794	81.1084	79.5000 (216)
Fuel for water heating, kWh/month	285.0082	254.7071	274.3516	243.6845	236.6962	212.2348	208.4895	218.5954	221.1711	245.8283	256.5324	281.4467 (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	18.6941	16.8849	18.6941	18.0910	18.6941	18.0910	18.6941	18.6941	18.0910	18.6941	18.0910	18.6941 (231)
Lighting	16.9417	13.5913	12.2374	8.9657	6.9253	5.6581	6.3175	8.2118	10.6663	13.9947	15.8070	17.4126 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												447.4957 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.5000
Water heating fuel used												2938.7457 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8260)												
mechanical ventilation fans (SFP = 0.8260)												134.1074 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												220.1074 (231)
Electricity for lighting (calculated in Appendix L)												136.7293 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)

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Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3743.0780 (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	447.4957	0.2100	93.9741	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2938.7457	0.2100	617.1366	(264)
Space and water heating			711.1107	(265)
Pumps, fans and electric keep-hot	220.1074	0.1387	30.5316	(267)
Energy for lighting	136.7293	0.1443	19.7343	(268)
Total CO2, kg/year			761.3766	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			13.7300	(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	447.4957	1.1300	505.6701	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2938.7457	1.1300	3320.7827	(278)
Space and water heating			3826.4528	(279)
Pumps, fans and electric keep-hot	220.1074	1.5128	332.9784	(281)
Energy for lighting	136.7293	1.5338	209.7199	(282)
Total Primary energy kWh/year			4369.1511	(286)
Dwelling Primary energy Rate (DPER)			78.7900	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	55.4500	(1b) x 2.4000 (2b)	133.0800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.4500			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.0800	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	20.0000 / (5) =	0.1503	(8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000		(17)
Infiltration rate	0.4003		(18)
Number of sides sheltered	2		(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3402	(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	0.4338	0.4253	0.4168	0.3743	0.3658	0.3232	0.3232	0.3147	0.3402	0.3658	0.3828	0.3998	(22b)
Effective ac	0.5941	0.5904	0.5869	0.5700	0.5669	0.5522	0.5522	0.5495	0.5579	0.5669	0.5733	0.5799	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			1.9700	1.0000	1.9700			(26a)
TER Opening Type (Uw = 1.20)			11.1000	1.1450	12.7099			(27)
External Wall 1	54.8300	13.0700	41.7600	0.1800	7.5168			(29a)
Total net area of external elements Aum(A, m2)			54.8300					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	22.1967		(33)

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Party Wall 1	17.9900					0.0000		0.0000					(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													340.8431 (35)
List of Thermal Bridges													
K1 Element						Length	Psi-value		Total				
E1 Steel lintel with perforated steel base plate						6.5000	0.0500		0.3250				
E3 Sill						2.2100	0.0500		0.1105				
E4 Jamb						17.3000	0.0500		0.8650				
E7 Party floor between dwellings (in blocks of flats)						45.6800	0.0700		3.1976				
E17 Corner (inverted - internal area greater than external area)						2.4000	-0.0900		-0.2160				
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)						15.0000	0.0000		0.0000				
E16 Corner (normal)						7.5000	0.0900		0.6750				
E18 Party wall between dwellings						2.4000	0.0600		0.1440				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													5.1011 (36)
Point Thermal bridges													0.0000
Total fabric heat loss													(33) + (36) + (36a) = 27.2978 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	26.0905	25.9301	25.7728	25.0340	24.8958	24.2523	24.2523	24.1332	24.5002	24.8958	25.1754	25.4677	(38)
Average = Sum(39)m / 12 =	53.3884	53.2279	53.0706	52.3318	52.1936	51.5502	51.5502	51.4310	51.7980	52.1936	52.4732	52.7656	(39)
												52.3312	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9628	0.9599	0.9571	0.9438	0.9413	0.9297	0.9297	0.9275	0.9341	0.9413	0.9463	0.9516	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												0.9438	
												31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													1.8505 (42)
Hot water usage for mixer showers	55.2469	54.4166	53.2068	50.8920	49.1837	47.2786	46.1958	47.3965	48.7127	50.7581	53.1226	55.0352	(42a)
Hot water usage for baths	23.8812	23.5265	23.0271	22.1062	21.4166	20.6520	20.2390	20.7350	21.2750	22.0931	23.0330	23.8005	(42b)
Hot water usage for other uses	33.5813	32.3602	31.1390	29.9179	28.6967	27.4756	27.4756	28.6967	29.9179	31.1390	32.3602	33.5813	(42c)
Average daily hot water use (litres/day)												103.6058	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7094	110.3033	107.3729	102.9160	99.2971	95.4063	93.9104	96.8282	99.9055	103.9903	108.5158	112.4170	(44)
Energy conte	178.5041	157.0704	165.0281	140.8869	133.6729	117.3131	113.5765	119.8936	123.1935	141.1138	154.6007	176.0178	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	26.7756	23.5606	24.7542	21.1330	20.0509	17.5970	17.0365	17.9840	18.4790	21.1671	23.1901	26.4027	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.6007	47.0497	47.8557	49.3426	49.2685	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
WWHRS	229.4630	203.0978	215.9870	190.2020	184.2736	164.3628	161.4323	169.2362	172.4620	192.0727	203.9157	226.9767	(62)
PV diverter	-25.2566	-22.3371	-23.3901	-19.3680	-18.0502	-15.4457	-14.4779	-15.3958	-15.9807	-18.8395	-21.3429	-24.7888	(63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
	204.2064	180.7607	192.5969	170.8340	166.2234	148.9171	146.9544	153.8404	156.4813	173.2332	182.5728	202.1878	(64)
Total per year (kWh/year) = Sum(64)m =													2078.8084 (64)
12Total per year (kWh/year)													2079 (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	72.0923	63.7328	67.6116	59.1737	57.0964	50.7690	49.7281	52.2003	53.2790	59.6601	63.7335	71.2656	(65)

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

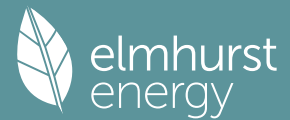
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.9454	90.7252	81.9454	84.6769	81.9454	84.6769	81.9454	81.9454	84.6769	81.9454	84.6769	81.9454	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	161.3446	163.0188	158.7997	149.8179	138.4799	127.8237	120.7048	119.0305	123.2496	132.2315	143.5695	154.2256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	(71)
Water heating gains (Table 5)	96.8983	94.8404	90.8758	82.1856	76.7425	70.5125	66.8389	70.1616	73.9986	80.1883	88.5187	95.7872	(72)
Total internal gains	393.9462	402.3424	385.3789	370.4384	350.9257	333.7711	320.2470	321.8955	332.6830	348.1231	370.5231	385.7161	(73)

6. Solar gains													

[Jan]													
				Area	Solar flux	g	FF			Access		Gains	
				m2	Table 6a	Specific data	Specific data			factor		W	
					W/m2	or Table 6b	or Table 6c			Table 6d			
East				3.0200	19.6403	0.6300	0.7000			0.7700		18.1270	(76)
West				8.0800	19.6403	0.6300	0.7000			0.7700		48.4987	(80)

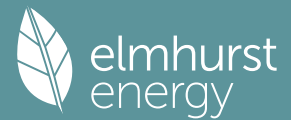
Solar gains	66.6258	130.3341	214.6417	313.0421	383.6449	392.7288	373.8938	321.1693	249.6372	154.6524	83.0745	54.7898	(83)
Total gains	460.5719	532.6765	600.0206	683.4805	734.5706	726.4999	694.1408	643.0648	582.3202	502.7755	453.5975	440.5059	(84)

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	98.3348	98.6312	98.9235	100.3200	100.5857	101.8412	101.8412	102.0771	101.3539	100.5857	100.0497	99.4954
alpha	7.5557	7.5754	7.5949	7.6880	7.7057	7.7894	7.7894	7.8051	7.7569	7.7057	7.6700	7.6330
util living area	0.9967	0.9895	0.9623	0.8484	0.6513	0.4536	0.3267	0.3678	0.6083	0.9160	0.9899	0.9976 (86)
MIT	20.3327	20.4909	20.7033	20.9174	20.9892	20.9994	21.0000	20.9999	20.9951	20.8727	20.5665	20.3093 (87)
Th 2	20.1144	20.1169	20.1192	20.1305	20.1326	20.1424	20.1424	20.1442	20.1386	20.1326	20.1283	20.1239 (88)
util rest of house	0.9953	0.9853	0.9482	0.8082	0.5945	0.3931	0.2631	0.2994	0.5351	0.8804	0.9851	0.9965 (89)
MIT 2	19.3505	19.5522	19.8145	20.0604	20.1257	20.1421	20.1423	20.1441	20.1362	20.0236	19.6584	19.3283 (90)
Living area fraction	fLA = Living area / (4) = 0.4537 (91)											
MIT	19.7962	19.9781	20.2178	20.4493	20.5175	20.5311	20.5315	20.5324	20.5259	20.4089	20.0705	19.7734 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7962	19.9781	20.2178	20.4493	20.5175	20.5311	20.5315	20.5324	20.5259	20.4089	20.0705	19.7734 (93)
8. Space heating requirement												
Utilisation												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9947	0.9845	0.9500	0.8237	0.6200	0.4206	0.2920	0.3305	0.5684	0.8930	0.9847	0.9960 (94)
Useful gains	458.1120	524.4029	570.0395	563.0016	455.4555	305.5401	202.6588	212.5105	330.9754	448.9692	446.6590	438.7458 (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	827.3170	802.5769	728.0121	604.3937	460.2190	305.7493	202.6686	212.5357	332.8509	511.9608	680.6017	821.7392 (97)
Space heating kWh	274.6886	186.9329	117.5316	29.8024	3.5440	0.0000	0.0000	0.0000	0.0000	46.8657	168.4387	284.9471 (98a)
Space heating requirement - total per year (kWh/year)	1112.7509											
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	274.6886	186.9329	117.5316	29.8024	3.5440	0.0000	0.0000	0.0000	0.0000	46.8657	168.4387	284.9471 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1112.7509											
Space heating per m2	(98c) / (4) = 20.0676 (99)											
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)	0.0000 (201)											
Efficiency of main space heating system 1 (in %)	1.0000 (202)											
Efficiency of main space heating system 2 (in %)	92.4000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (207)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	274.6886	186.9329	117.5316	29.8024	3.5440	0.0000	0.0000	0.0000	0.0000	46.8657	168.4387	284.9471 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	297.2820	202.3083	127.1987	32.2536	3.8355	0.0000	0.0000	0.0000	0.0000	50.7205	182.2930	308.3843 (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	204.2064	180.7607	192.5969	170.8340	166.2234	148.9171	146.9544	153.8404	156.4813	173.2332	182.5728	202.1878 (64)
Efficiency of water heater												80.3000 (216)
(217)m	85.0174	84.4535	83.3560	81.4707	80.4625	80.3000	80.3000	80.3000	80.3000	81.9888	84.2091	85.1164 (217)
Fuel for water heating, kWh/month	240.1936	214.0358	231.0535	209.6877	206.5849	185.4509	183.0067	191.5820	194.8708	211.2887	216.8089	237.5427 (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	17.0266	13.6594	12.2988	9.0106	6.9601	5.6864	6.3492	8.2529	10.7197	14.0649	15.8862	17.4999 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-19.0259	-27.7762	-41.3387	-48.1964	-53.4857	-50.5025	-49.9085	-46.3784	-40.3873	-32.5437	-21.2613	-16.3414 (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	-8.0373	-17.1576	-34.5611	-52.5752	-70.1557	-70.6989	-69.8430	-58.8247	-42.7245	-24.7302	-10.7954	-6.3354 (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	1204.2759 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	80.3000											
Water heating fuel used	2522.1064 (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)	137.4146 (232)											
Energy saving/generation technologies (Appendices M ,N and O)												

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PV generation	-913.5851 (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	3036.2119 (238)

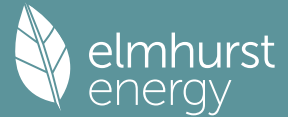
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1204.2759	0.2100	252.8979 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2522.1064	0.2100	529.6423 (264)
Space and water heating			782.5403 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	137.4146	0.1443	19.8332 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-447.1460	0.1338	-59.8443
PV Unit electricity exported	-466.4390	0.1255	-58.5528
Total			-118.3971 (269)
Total CO2, kg/year			695.9056 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5500 (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	1204.2759	1.1300	1360.8318 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2522.1064	1.1300	2849.9802 (278)
Space and water heating			4210.8120 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	137.4146	1.5338	210.7712 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-447.1460	1.4946	-668.3012
PV Unit electricity exported	-466.4390	0.4608	-214.9216
Total			-883.2228 (283)
Total Primary energy kWh/year			3668.4612 (286)
Target Primary Energy Rate (TPER)			66.1600 (287)

Full SAP Calculation Printout



Property Reference	Type 2 end East mid floor				Issued on Date	15/04/2024	
Assessment Reference	Type 2 end East EAHF			Prop Type Ref			
Property							
SAP Rating	85 B	DER	3.64	TER	11.96		
Environmental	97 A	% DER < TER				69.57	
CO ₂ Emissions (t/year)	0.21	DFEE	24.74	TFEE	27.13		
Compliance Check	See BREL	% DFEE < TFEE				8.82	
% DPER < TPER	38.52	DPER	38.72	TPER	62.97		
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.4500 (1b)	2.4000 (2b)	133.0800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.0800 (5)

2. Ventilation rate

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

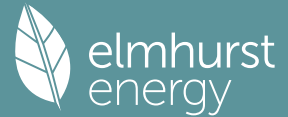
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												68.8000 (23c)
Effective ac	0.3186	0.3154	0.3122	0.2963	0.2931	0.2771	0.2771	0.2739	0.2835	0.2931	0.2994	0.3058 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			11.1000	1.1450	12.7099		(27)
Door			1.9700	1.2000	2.3640		(26a)
External Wall 1	54.8300	13.0700	41.7600	0.1500	6.2640	110.0000	4593.6000 (29a)
Total net area of external elements Aum(A, m ²)			54.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.3379		(33)
Party Wall 1			17.9900	0.0000	0.0000	110.0000	1978.9000 (32)
Party Floor 1			55.4500			30.0000	1663.5000 (32a)
Party Ceiling 1			55.4500			30.0000	1663.5000 (32b)
Internal Wall 1			112.6100			75.0000	8445.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18345.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							330.8431 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				6.5000	0.1500	0.9750	

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E3 Sill	2.2100	0.0400	0.0884	
E4 Jamb	17.3000	0.0500	0.8650	
E7 Party floor between dwellings (in blocks of flats)	45.6800	0.0300	1.3704	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0300	-0.0720	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	15.0000	0.0000	0.0000	
E16 Corner (normal)	7.5000	0.0900	0.6750	
E18 Party wall between dwellings	2.4000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.9018	(36)
Point Thermal bridges			0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	25.2397	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	13.9901	13.8501	13.7102	13.0102	12.8702	12.1703	12.1703	12.0303	12.4503	12.8702	13.1502	13.4302 (38)
Average = Sum(39)m / 12 =	39.2298	39.0899	38.9499	38.2500	38.1100	37.4101	37.4101	37.2701	37.6900	38.1100	38.3899	38.6699 (39)
												38.2150
HLP	0.7075	0.7050	0.7024	0.6898	0.6873	0.6747	0.6747	0.6721	0.6797	0.6873	0.6923	0.6974 (40)
HLP (average)												0.6892
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8505	(42)
Hot water usage for mixer showers														
Hot water usage for baths	55.2469	54.4166	53.2068	50.8920	49.1837	47.2786	46.1958	47.3965	48.7127	50.7581	53.1226	55.0352	(42a)	
Hot water usage for other uses	23.8812	23.5265	23.0271	22.1062	21.4166	20.6520	20.2390	20.7350	21.2750	22.0931	23.0330	23.8005	(42b)	
Average daily hot water use (litres/day)	33.5813	32.3602	31.1390	29.9179	28.6967	27.4756	27.4756	28.6967	29.9179	31.1390	32.3602	33.5813	(42c)	
												103.6058	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	112.7094	110.3033	107.3729	102.9160	99.2971	95.4063	93.9104	96.8282	99.9055	103.9903	108.5158	112.4170	(44)	
Energy content (annual)	178.5041	157.0704	165.0281	140.8869	133.6729	117.3131	113.5765	119.8936	123.1935	141.1138	154.6007	176.0178	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1720.8715		
Water storage loss:	26.7756	23.5606	24.7542	21.1330	20.0509	17.5970	17.0365	17.9840	18.4790	21.1671	23.1901	26.4027	(46)	
Store volume												180.0000	(47)	
a) If manufacturer declared loss factor is known (kWh/day):												0.8400	(48)	
Temperature factor from Table 2b												0.5400	(49)	
Enter (49) or (54) in (55)												0.4536	(55)	
Total storage loss	14.0616	12.7008	14.0616	13.6080	14.0616	13.6080	14.0616	14.0616	13.6080	14.0616	13.6080	14.0616	(56)	
If cylinder contains dedicated solar storage	14.0616	12.7008	14.0616	13.6080	14.0616	13.6080	14.0616	14.0616	13.6080	14.0616	13.6080	14.0616	(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	192.5657	169.7712	179.0897	154.4949	147.7345	130.9211	127.6381	133.9552	136.8015	155.1754	168.2087	190.0794	(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	192.5657	169.7712	179.0897	154.4949	147.7345	130.9211	127.6381	133.9552	136.8015	155.1754	168.2087	190.0794	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1886.4355	(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	59.3526	52.2259	54.8718	46.8449	44.4463	39.0066	37.7642	39.8646	40.9618	46.9203	51.4047	58.5259	(65)	

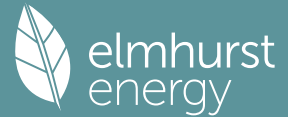
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	81.3798	90.0991	81.3798	84.0925	81.3798	84.0925	81.3798	81.3798	84.0925	81.3798	84.0925	81.3798	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	161.3446	163.0188	158.7997	149.8179	138.4799	127.8237	120.7048	119.0305	123.2496	132.2315	143.5695	154.2256	(68)	
Pumps, fans	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	(69)	
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Water heating gains (Table 5)	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	(71)	
Total internal gains	79.7750	77.7711	73.7525	65.0624	59.7396	54.1759	50.7583	53.5815	56.8914	63.0650	71.3954	78.6639	(72)	
	373.2573	381.5930	364.6900	349.7307	330.3572	316.8500	303.6009	304.7498	314.9915	327.4342	349.8154	365.0272	(73)	

6. Solar gains

[Jan]														
		Area		Solar flux		g		FF		Access		Gains		
		m2		Table 6a		Specific data		Specific data		factor		W		
				W/m2		or Table 6b		or Table 6c		Table 6d				
East		3.0200		19.6403		0.4300		0.8000		0.7700		14.1399	(76)	
West		8.0800		19.6403		0.4300		0.8000		0.7700		37.8312	(80)	
Solar gains	51.9711	101.6665	167.4303	244.1871	299.2604	306.3463	291.6541	250.5266	194.7283	120.6359	64.8019	42.7385	(83)	
Total gains	425.2285	483.2595	532.1203	593.9177	629.6176	623.1963	595.2550	555.2764	509.7198	448.0701	414.6172	407.7658	(84)	

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	129.8986	130.3638	130.8323	133.2264	133.7157	136.2175	136.2175	136.7291	135.2056	133.7157	132.7406	131.7795
alpha	9.6599	9.6909	9.7222	9.8818	9.9144	10.0812	10.0812	10.1153	10.0137	9.9144	9.8494	9.7853
util living area	0.9946	0.9809	0.9313	0.7636	0.5621	0.3842	0.2765	0.3087	0.5099	0.8435	0.9801	0.9961 (86)
Living	20.6179	20.7444	20.8861	20.9846	20.9991	21.0000	21.0000	21.0000	20.9998	20.9697	20.7902	20.5988
Non living	19.8973	20.0566	20.2257	20.3374	20.3515	20.3633	20.3633	20.3655	20.3587	20.3279	20.1245	19.8807
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.3342	20.3365	20.3387	20.3498	20.3521	20.3633	20.3633	20.3655	20.3588	20.3521	20.3476	20.3431 (88)
util rest of house	0.9925	0.9745	0.9125	0.7275	0.5233	0.3460	0.2365	0.2662	0.4627	0.8040	0.9723	0.9946 (89)
MIT 2	20.3342	20.3365	20.3387	20.3498	20.3521	20.3633	20.3633	20.3655	20.3588	20.3521	20.3476	20.3431 (90)
Living area fraction	20.6363	20.6375	20.6388	20.6448	20.6461	20.6522	20.6522	20.6534	20.6497	20.6461	20.6436	20.6412 (91)
MIT	20.6363	20.6375	20.6388	20.6448	20.6461	20.6522	20.6522	20.6534	20.6497	20.6461	20.6436	20.6412 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6363	20.6375	20.6388	20.6448	20.6461	20.6522	20.6522	20.6534	20.6497	20.6461	20.6436	20.6412 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9935	0.9776	0.9215	0.7441	0.5409	0.3633	0.2547	0.2855	0.4841	0.8226	0.9762	0.9953 (94)
Useful gains	422.4729	472.4479	490.3531	441.9564	340.5769	226.4071	151.5922	158.5243	246.7701	368.5740	404.7334	405.8553 (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	640.8712	615.1780	550.7026	449.2399	340.9344	226.4124	151.5923	158.5247	246.8596	382.8554	519.9390	635.7792 (97)
Space heating kWh	162.4883	95.9146	44.9000	5.2441	0.2660	0.0000	0.0000	0.0000	0.0000	10.6254	82.9481	171.0634 (98a)
Space heating requirement - total per year (kWh/year)												573.4499
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	162.4883	95.9146	44.9000	5.2441	0.2660	0.0000	0.0000	0.0000	0.0000	10.6254	82.9481	171.0634 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												573.4499
Space heating per m2										(98c) / (4) =		10.3417 (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 %)												299.2182 (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	162.4883	95.9146	44.9000	5.2441	0.2660	0.0000	0.0000	0.0000	0.0000	10.6254	82.9481	171.0634 (98)
Space heating efficiency (main heating system 1)	299.2182	299.2182	299.2182	299.2182	299.2182	0.0000	0.0000	0.0000	0.0000	299.2182	299.2182	299.2182 (210)
Space heating fuel (main heating system)	54.3043	32.0551	15.0058	1.7526	0.0889	0.0000	0.0000	0.0000	0.0000	3.5510	27.7216	57.1701 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	192.5657	169.7712	179.0897	154.4949	147.7345	130.9211	127.6381	133.9552	136.8015	155.1754	168.2087	190.0794 (64)
Efficiency of water heater												194.1800 (216)
(217)m	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800 (217)
Fuel for water heating, kWh/month	99.1687	87.4298	92.2287	79.5627	76.0812	67.4226	65.7319	68.9850	70.4509	79.9132	86.6251	97.8882 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	8.6017	7.7693	8.6017	8.3242	8.6017	8.3242	8.6017	8.6017	8.3242	8.6017	8.3242	8.6017 (231)
Lighting	16.9417	13.5913	12.2374	8.9657	6.9253	5.6581	6.3175	8.2118	10.6663	13.9947	15.8070	17.4126 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												191.6494 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												194.1800
Water heating fuel used												971.4880 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)

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mechanical ventilation fans (SFP = 1.0640) 101.2779 (230a)
 Total electricity for the above, kWh/year 101.2779 (231)
 Electricity for lighting (calculated in Appendix L) 136.7293 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation 0.0000 (233)
 Wind generation 0.0000 (234)
 Hydro-electric generation (Appendix N) 0.0000 (235a)
 Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
 Appendix Q - special features
 Energy saved or generated -0.0000 (236)
 Energy used 0.0000 (237)
 Total delivered energy for all uses 1401.1446 (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	191.6494	0.1593	30.5263 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	971.4880	0.1413	137.2971 (264)
Space and water heating			167.8234 (265)
Pumps, fans and electric keep-hot	101.2779	0.1387	14.0485 (267)
Energy for lighting	136.7293	0.1443	19.7343 (268)
Total CO2, kg/year			201.6061 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	191.6494	1.5895	304.6338 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	971.4880	1.5226	1479.1834 (278)
Space and water heating			1783.8172 (279)
Pumps, fans and electric keep-hot	101.2779	1.5128	153.2132 (281)
Energy for lighting	136.7293	1.5338	209.7199 (282)
Total Primary energy kWh/year			2146.7504 (286)
Dwelling Primary energy Rate (DPER)			38.7200 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	55.4500 (1b)	2.4000 (2b)	133.0800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.0800 (5)

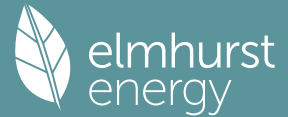
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1503 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4003 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3402 (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	0.4338	0.4253	0.4168	0.3743	0.3658	0.3232	0.3232	0.3147	0.3402	0.3658	0.3828	0.3998 (22b)
Effective ac	0.5941	0.5904	0.5869	0.5700	0.5669	0.5522	0.5522	0.5495	0.5579	0.5669	0.5733	0.5799 (25)

3. Heat losses and heat loss parameter

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Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			1.9700	1.0000	1.9700			(26a)
TER Opening Type (Uw = 1.20)			11.1000	1.1450	12.7099			(27)
External Wall 1	54.8300	13.0700	41.7600	0.1800	7.5168			(29a)
Total net area of external elements Aum(A, m2)			54.8300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.1967			(33)
Party Wall 1			17.9900	0.0000	0.0000			(32)

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

340.8431 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	6.5000	0.0500	0.3250
E3 Sill	2.2100	0.0500	0.1105
E4 Jamb	17.3000	0.0500	0.8650
E7 Party floor between dwellings (in blocks of flats)	45.6800	0.0700	3.1976
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	15.0000	0.0000	0.0000
E16 Corner (normal)	7.5000	0.0900	0.6750
E18 Party wall between dwellings	2.4000	0.0600	0.1440

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

5.1011 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 27.2978 (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	26.0905	25.9301	25.7728	25.0340	24.8958	24.2523	24.2523	24.1332	24.5002	24.8958	25.1754	25.4677
Heat transfer coeff	53.3884	53.2279	53.0706	52.3318	52.1936	51.5502	51.5502	51.4310	51.7980	52.1936	52.4732	52.7656
Average = Sum(39)m / 12 =												52.3312

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9628	0.9599	0.9571	0.9438	0.9413	0.9297	0.9297	0.9275	0.9341	0.9413	0.9463	0.9516
HLP (average)												0.9438
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy

1.8505 (42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	55.2469	54.4166	53.2068	50.8920	49.1837	47.2786	46.1958	47.3965	48.7127	50.7581	53.1226	55.0352
Hot water usage for baths	23.8812	23.5265	23.0271	22.1062	21.4166	20.6520	20.2390	20.7350	21.2750	22.0931	23.0330	23.8005
Hot water usage for other uses	33.5813	32.3602	31.1390	29.9179	28.6967	27.4756	27.4756	28.6967	29.9179	31.1390	32.3602	33.5813
Average daily hot water use (litres/day)												103.6058

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7094	110.3033	107.3729	102.9160	99.2971	95.4063	93.9104	96.8282	99.9055	103.9903	108.5158	112.4170
Energy conte	178.5041	157.0704	165.0281	140.8869	133.6729	117.3131	113.5765	119.8936	123.1935	141.1138	154.6007	176.0178
Energy content (annual)										Total = Sum(45)m =		1720.8715

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

Distribution loss	26.7756	23.5606	24.7542	21.1330	20.0509	17.5970	17.0365	17.9840	18.4790	21.1671	23.1901	26.4027
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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

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
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If cylinder contains dedicated solar storage

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
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total heat required for water heating calculated for each month

Total heat required for water heating calculated for each month	225.0990	199.1562	211.6230	185.9787	180.2678	162.4050	160.1714	166.4885	168.2854	187.7087	199.6925	222.6127
WWHRS	-25.2566	-22.3371	-23.3901	-19.3680	-18.0502	-15.4457	-14.4779	-15.3958	-15.9807	-18.8395	-21.3429	-24.7888
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Output from w/h

Output from w/h	199.8424	176.8190	188.2329	166.6108	162.2176	146.9593	145.6935	151.0927	152.3046	168.8692	178.3496	197.8238
Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				2034.8154
												2035

12Total per year (kWh/year)

Electric shower(s)

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

Heat gains from water heating, kWh/month

Heat gains from water heating, kWh/month	96.6285	85.8945	92.1478	82.9184	81.7222	75.0801	75.0401	77.1405	77.0353	84.1963	87.4782	95.8018
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.9454	90.7252	81.9454	84.6769	81.9454	84.6769	81.9454	81.9454	84.6769	81.9454	84.6769	81.9454
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	161.3446	163.0188	158.7997	149.8179	138.4799	127.8237	120.7048	119.0305	123.2496	132.2315	143.5695	154.2256

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

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
Losses e.g. evaporation (negative values) (Table 5)	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213

Water heating gains (Table 5)

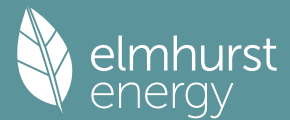
Water heating gains (Table 5)	129.8771	127.8192	123.8545	115.1644	109.8416	104.2779	100.8604	103.6835	106.9935	113.1670	121.4975	128.7659
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Total internal gains

Total internal gains	426.9250	435.3212	418.3576	403.4171	384.0248	367.5365	354.2685	355.4174	365.6779	381.1018	403.5018	418.6949
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6. Solar gains

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[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	Specific data or Table 6c	FF				Access factor Table 6d	Gains W
East				3.0200	19.6403	0.6300		0.7000				0.7700	18.1270 (76)
West				8.0800	19.6403	0.6300		0.7000				0.7700	48.4987 (80)
Solar gains	66.6258	130.3341	214.6417	313.0421	383.6449	392.7288	373.8938	321.1693	249.6372	154.6524	83.0745	54.7898 (83)	
Total gains	493.5507	565.6553	632.9993	716.4592	767.6697	760.2653	728.1623	676.5867	615.3151	535.7542	486.5763	473.4846 (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	98.3348	98.6312	98.9235	100.3200	100.5857	101.8412	101.8412	102.0771	101.3539	100.5857	100.0497	99.4954	
alpha	7.5557	7.5754	7.5949	7.6880	7.7057	7.7894	7.7894	7.8051	7.7569	7.7057	7.6700	7.6330	
util living area	0.9948	0.9850	0.9505	0.8234	0.6254	0.4336	0.3115	0.3496	0.5772	0.8908	0.9846	0.9961 (86)	
MIT	20.3820	20.5373	20.7408	20.9331	20.9918	20.9996	21.0000	20.9999	20.9965	20.8986	20.6130	20.3590 (87)	
Th 2	20.1144	20.1169	20.1192	20.1305	20.1326	20.1424	20.1424	20.1442	20.1386	20.1326	20.1283	20.1239 (88)	
util rest of house	0.9927	0.9792	0.9333	0.7811	0.5699	0.3757	0.2508	0.2846	0.5070	0.8498	0.9776	0.9945 (89)	
MIT 2	19.4130	19.6097	19.8577	20.0748	20.1274	20.1422	20.1423	20.1442	20.1370	20.0487	19.7156	19.3915 (90)	
Living area fraction	fLA = Living area / (4) =												
MIT	19.8527	20.0306	20.2584	20.4642	20.5196	20.5312	20.5315	20.5325	20.5270	20.4343	20.1228	19.8305 (92)	
Temperature adjustment	0.0000												
adjusted MIT	19.8527	20.0306	20.2584	20.4642	20.5196	20.5312	20.5315	20.5325	20.5270	20.4343	20.1228	19.8305 (93)	
8. Space heating requirement													
Utilisation	0.9919	0.9785	0.9364	0.7981	0.5949	0.4020	0.2783	0.3141	0.5389	0.8653	0.9775	0.9938 (94)	
Useful gains	489.5737	553.4832	592.7196	571.8012	456.7034	305.6034	202.6620	212.5192	331.5970	463.5834	475.6443	470.5433 (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	830.3329	805.3692	730.1687	605.1772	460.3266	305.7550	202.6689	212.5365	332.9054	513.2879	683.3481	824.7528 (97)	
Space heating kWh	253.5248	169.2674	102.2621	24.0307	2.6957	0.0000	0.0000	0.0000	0.0000	36.9801	149.5468	263.5319 (98a)	
Space heating requirement - total per year (kWh/year)												1001.8395	
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	253.5248	169.2674	102.2621	24.0307	2.6957	0.0000	0.0000	0.0000	0.0000	36.9801	149.5468	263.5319 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1001.8395	
Space heating per m2	(98c) / (4) =											18.0674 (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	253.5248	169.2674	102.2621	24.0307	2.6957	0.0000	0.0000	0.0000	0.0000	36.9801	149.5468	263.5319 (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)	274.6747	183.3883	110.7932	26.0355	2.9206	0.0000	0.0000	0.0000	0.0000	40.0651	162.0225	285.5167 (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	199.8424	176.8190	188.2329	166.6108	162.2176	146.9593	145.6935	151.0927	152.3046	168.8692	178.3496	197.8238 (64)	
Efficiency of water heater (217)m	84.5945	83.9620	82.7525	80.8327	79.9324	79.8000	79.8000	79.8000	79.8000	81.2799	83.6675	79.8000 (216)	
Fuel for water heating, kWh/month	236.2358	210.5942	227.4649	206.1181	202.9434	184.1595	182.5734	189.3392	190.8579	207.7626	213.1648	233.5479 (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	17.0266	13.6594	12.2988	9.0106	6.9601	5.6864	6.3492	8.2529	10.7197	14.0649	15.8862	17.4999 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-19.0259	-27.7762	-41.3387	-48.1964	-53.4857	-50.5025	-49.9085	-46.3784	-40.3873	-32.5437	-21.2613	-16.3414 (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	-8.0373	-17.1576	-34.5611	-52.5752	-70.1557	-70.6989	-69.8430	-58.8247	-42.7245	-24.7302	-10.7954	-6.3354 (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	1085.4166 (211)												

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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	2484.7616	(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)	137.4146	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-913.5851	(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	2880.0077	(238)

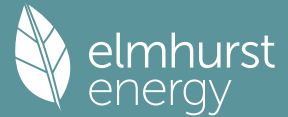
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1085.4166	0.2100	227.9375 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2484.7616	0.2100	521.7999 (264)
Space and water heating			749.7374 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	137.4146	0.1443	19.8332 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-447.1460	0.1338	-59.8443
PV Unit electricity exported	-466.4390	0.1255	-58.5528
Total			-118.3971 (269)
Total CO2, kg/year			663.1027 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1085.4166	1.1300	1226.5207 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2484.7616	1.1300	2807.7806 (278)
Space and water heating			4034.3013 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	137.4146	1.5338	210.7712 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-447.1460	1.4946	-668.3012
PV Unit electricity exported	-466.4390	0.4608	-214.9216
Total			-883.2228 (283)
Total Primary energy kWh/year			3491.9505 (286)
Target Primary Energy Rate (TPER)			62.9700 (287)

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Property Reference	Type 2 end East			Issued on Date	15/04/2024
Assessment Reference	Type 2 end East Be Lean	Prop Type Ref			
Property					
SAP Rating	83 B	DER	15.37	TER	14.72
Environmental	89 B	% DER < TER			-4.42
CO ₂ Emissions (t/year)	0.78	DFEE	33.54	TFEE	36.81
Compliance Check	See BREL	% DFEE < TFEE			8.88
% DPER < TPER	-12.61	DPER	87.62	TPER	77.81
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.4500 (1b)	2.4000 (2b)	133.0800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.0800 (5)

2. Ventilation rate

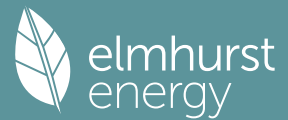
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												75.2000 (23c)
Effective ac	0.2866	0.2834	0.2802	0.2642	0.2611	0.2451	0.2451	0.2419	0.2515	0.2611	0.2674	0.2738 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			11.1000	1.1450	12.7099		(27)
Door			1.9700	1.2000	2.3640		(26a)
Heatloss Floor 1			55.4500	0.1200	6.6540	110.0000	6099.5000 (28a)
External Wall 1	54.8300	13.0700	41.7600	0.1500	6.2640	110.0000	4593.6000 (29a)
Total net area of external elements Aum(A, m ²)			110.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.9919		(33)
Party Wall 1			17.9900	0.0000	0.0000	110.0000	1978.9000 (32)
Party Ceiling 1			55.4500			30.0000	1663.5000 (32b)
Internal Wall 1			112.6100			75.0000	8445.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22781.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							410.8431 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
P1 Party wall - Ground floor					7.5000	0.1200	0.9000

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E1 Steel lintel with perforated steel base plate	6.5000	0.1500	0.9750
E3 Sill	2.2100	0.0400	0.0884
E4 Jamb	17.3000	0.0500	0.8650
E5 Ground floor (normal)	22.8400	0.0800	1.8272
E7 Party floor between dwellings (in blocks of flats)	22.8400	0.0300	0.6852
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0300	-0.0720
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0000	0.0000
E16 Corner (normal)	7.5000	0.0900	0.6750
E18 Party wall between dwellings	2.4000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal Bridges (36a) = 5.9438 (36)
 Total fabric heat loss (33) + (36) + (36a) = 33.9357 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	12.5848	12.4448	12.3048	11.6049	11.4649	10.7650	10.7650	10.6250	11.0450	11.4649	11.7449	12.0249 (38)
Average = Sum(39)m / 12 =	46.5205	46.3805	46.2405	45.5406	45.4006	44.7007	44.7007	44.5607	44.9807	45.4006	45.6806	45.9606 (39)
HLP	0.8390	0.8364	0.8339	0.8213	0.8188	0.8061	0.8061	0.8036	0.8112	0.8188	0.8238	0.8289 (40)
HLP (average)												0.8207
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8505 (42)											
Hot water usage for mixer showers	55.2469	54.4166	53.2068	50.8920	49.1837	47.2786	46.1958	47.3965	48.7127	50.7581	53.1226	55.0352 (42a)
Hot water usage for baths	25.1381	24.7648	24.2390	23.2697	22.5438	21.7390	21.3042	21.8263	22.3947	23.2559	24.2453	25.0531 (42b)
Hot water usage for other uses	35.3487	34.0633	32.7779	31.4925	30.2071	28.9217	28.9217	30.2071	31.4925	32.7779	34.0633	35.3487 (42c)
Average daily hot water use (litres/day)												106.3780 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7337	113.2447	110.2237	105.6541	101.9346	97.9393	96.4217	99.4299	102.5999	106.7920	111.4312	115.4371 (44)
Energy content (annual)	183.2939	161.2590	169.4098	144.6352	137.2236	120.4278	116.6137	123.1150	126.5159	144.9157	158.7542	180.7465 (45)
Distribution loss (46)m = 0.15 x (45)m	27.4941	24.1888	25.4115	21.6953	20.5835	18.0642	17.4921	18.4672	18.9774	21.7374	23.8131	27.1120 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	48.2988	49.1355	50.6684	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	234.2528	207.2864	220.3687	193.9503	188.1825	168.7266	165.7492	173.7833	175.8310	195.8746	208.0693	231.7054 (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	234.2528	207.2864	220.3687	193.9503	188.1825	168.7266	165.7492	173.7833	175.8310	195.8746	208.0693	231.7054 (64)
12Total per year (kWh/year)												2363.7801 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	73.6849	65.1255	69.0685	60.4200	58.3666	52.1170	51.0579	53.6028	54.3953	60.9242	65.1145	72.8379 (65)

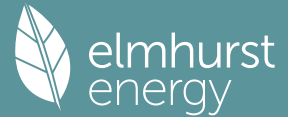
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.3798	90.0991	81.3798	84.0925	81.3798	84.0925	81.3798	81.3798	84.0925	81.3798	84.0925	81.3798 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	161.3446	163.0188	158.7997	149.8179	138.4799	127.8237	120.7048	119.0305	123.2496	132.2315	143.5695	154.2256 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213 (71)
Water heating gains (Table 5)	99.0389	96.9129	92.8340	83.9166	78.4497	72.3847	68.6262	72.0468	75.5490	81.8874	90.4369	97.9005 (72)
Total internal gains	395.5212	403.7887	386.7715	371.5849	352.0673	335.0588	321.4688	323.2151	333.6491	349.2566	371.8568	387.2638 (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	3.0200	19.6403	0.4300	0.8000	0.7700	14.1399 (76)
West	8.0800	19.6403	0.4300	0.8000	0.7700	37.8312 (80)
Solar gains	51.9711	101.6665	167.4303	244.1871	299.2604	306.3463
Total gains	447.4923	505.4552	554.2018	615.7720	651.3277	641.4051
						291.6541
						613.1230
						573.7417
						528.3774
						469.8925
						436.6586
						42.7385 (83)
						430.0024 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	136.0287	136.4392	136.8523	138.9556	139.3840	141.5665	141.5665	142.0112	140.6853	139.3840	138.5298	137.6859
alpha	10.0686	10.0959	10.1235	10.2637	10.2923	10.4378	10.4378	10.4674	10.3790	10.2923	10.2353	10.1791
util living area	0.9984	0.9936	0.9713	0.8527	0.6456	0.4460	0.3208	0.3573	0.5864	0.9136	0.9931	0.9989 (86)
MIT	20.5604	20.6744	20.8239	20.9654	20.9977	21.0000	21.0000	21.0000	20.9993	20.9428	20.7315	20.5432 (87)
Th 2	20.2197	20.2219	20.2240	20.2349	20.2371	20.2480	20.2480	20.2502	20.2436	20.2371	20.2327	20.2284 (88)
util rest of house	0.9975	0.9905	0.9587	0.8126	0.5939	0.3936	0.2660	0.2990	0.5227	0.8755	0.9892	0.9983 (89)
MIT 2	19.7170	19.8630	20.0474	20.2078	20.2358	20.2480	20.2480	20.2502	20.2434	20.1923	19.9452	19.7025 (90)
Living area fraction	20.0997	20.2312	20.3998	20.5515	20.5815	20.5892	20.5892	20.5904	fLA = Living area / (4) =	20.5329	20.3020	0.4537 (91)
MIT	20.0997	20.2312	20.3998	20.5515	20.5815	20.5892	20.5892	20.5904	20.5864	20.5329	20.3020	20.0840 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.9497	20.0812	20.2498	20.4015	20.4315	20.4392	20.4392	20.4404	20.4364	20.3829	20.1520	19.9340 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9898	0.9592	0.8218	0.6072	0.4069	0.2799	0.3138	0.5390	0.8836	0.9886	0.9980 (94)
Useful gains	446.2027	500.3045	531.5872	506.0522	395.4768	261.0031	171.6157	180.0431	284.7977	415.2029	431.6869	429.1220 (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	728.0329	704.1103	635.7965	523.7878	396.4161	261.0161	171.6159	180.0438	285.0146	444.1477	596.2212	723.1423 (97)
Space heating kWh	209.6817	136.9574	77.5317	12.7696	0.6989	0.0000	0.0000	0.0000	0.0000	21.5350	118.4647	218.7512 (98a)
Space heating requirement - total per year (kWh/year)												796.3902
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	209.6817	136.9574	77.5317	12.7696	0.6989	0.0000	0.0000	0.0000	0.0000	21.5350	118.4647	218.7512 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												796.3902
Space heating per m2										(98c) / (4) =		14.3623 (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 %)												88.1000 (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	209.6817	136.9574	77.5317	12.7696	0.6989	0.0000	0.0000	0.0000	0.0000	21.5350	118.4647	218.7512 (98)
Space heating efficiency (main heating system 1)	88.1000	88.1000	88.1000	88.1000	88.1000	0.0000	0.0000	0.0000	0.0000	88.1000	88.1000	88.1000 (210)
Space heating fuel (main heating system)	238.0042	155.4568	88.0042	14.4945	0.7933	0.0000	0.0000	0.0000	0.0000	24.4438	134.4662	248.2987 (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	234.2528	207.2864	220.3687	193.9503	188.1825	168.7266	165.7492	173.7833	175.8310	195.8746	208.0693	231.7054 (64)
Efficiency of water heater (217)m	83.3427	82.7123	81.5724	79.9823	79.5287	79.5000	79.5000	79.5000	79.5000	80.2762	82.4188	79.5000 (216)
Fuel for water heating, kWh/month	281.0719	250.6114	270.1510	242.4916	236.6220	212.2348	208.4895	218.5954	221.1711	244.0008	252.4536	83.4562 (217)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	18.6941	16.8849	18.6941	18.0910	18.6941	18.0910	18.6941	18.6941	18.0910	18.6941	18.0910	18.6941 (231)
Lighting	16.9417	13.5913	12.2374	8.9657	6.9253	5.6581	6.3175	8.2118	10.6663	13.9947	15.8070	17.4126 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												903.9616 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.5000
Water heating fuel used												2915.5302 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8260)												
mechanical ventilation fans (SFP = 0.8260)												134.1074 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												220.1074 (231)
Electricity for lighting (calculated in Appendix L)												136.7293 (232)

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

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PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4176.3285 (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	903.9616	0.2100	189.8319 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2915.5302	0.2100	612.2613 (264)
Space and water heating			802.0933 (265)
Pumps, fans and electric keep-hot	220.1074	0.1387	30.5316 (267)
Energy for lighting	136.7293	0.1443	19.7343 (268)
Total CO2, kg/year			852.3591 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.3700 (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	903.9616	1.1300	1021.4766 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2915.5302	1.1300	3294.5491 (278)
Space and water heating			4316.0258 (279)
Pumps, fans and electric keep-hot	220.1074	1.5128	332.9784 (281)
Energy for lighting	136.7293	1.5338	209.7199 (282)
Total Primary energy kWh/year			4858.7241 (286)
Dwelling Primary energy Rate (DPER)			87.6200 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	55.4500 (1b)	2.4000 (2b)	133.0800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.0800 (5)

2. Ventilation rate

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

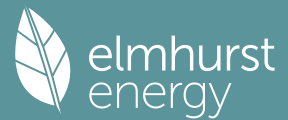
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1503 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4003	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3402 (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	0.4338	0.4253	0.4168	0.3743	0.3658	0.3232	0.3232	0.3147	0.3402	0.3658	0.3828	0.3998 (22b)
Effective ac	0.5941	0.5904	0.5869	0.5700	0.5669	0.5522	0.5522	0.5495	0.5579	0.5669	0.5733	0.5799 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			1.9700	1.0000	1.9700		(26a)
TER Opening Type (Uw = 1.20)			11.1000	1.1450	12.7099		(27)
Heatloss Floor 1			55.4500	0.1300	7.2085		(28a)

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External Wall 1	54.8300	13.0700	41.7600	0.1800	7.5168	(29a)
Total net area of external elements Aum(A, m2)			110.2800			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4052	(33)
Party Wall 1			17.9900	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 420.8431 (35)

List of Thermal Bridges						
K1 Element	Length	Psi-value	Total			
P1 Party wall - Ground floor	7.5000	0.0800	0.6000			
E1 Steel lintel with perforated steel base plate	6.5000	0.0500	0.3250			
E3 Sill	2.2100	0.0500	0.1105			
E4 Jamb	17.3000	0.0500	0.8650			
E5 Ground floor (normal)	22.8400	0.1600	3.6544			
E7 Party floor between dwellings (in blocks of flats)	22.8400	0.0700	1.5988			
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160			
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0000	0.0000			
E16 Corner (normal)	7.5000	0.0900	0.6750			
E18 Party wall between dwellings	2.4000	0.0600	0.1440			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.7567 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 37.1619 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	26.0905	25.9301	25.7728	25.0340	24.8958	24.2523	24.2523	24.1332	24.5002	24.8958	25.1754	25.4677
Average = Sum(39)m / 12 =	63.2525	63.0920	62.9347	62.1959	62.0577	61.4143	61.4143	61.2951	61.6621	62.0577	62.3373	62.6297

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1407	1.1378	1.1350	1.1217	1.1192	1.1076	1.1076	1.1054	1.1120	1.1192	1.1242	1.1295
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8505 (42)
Hot water usage for mixer showers													
Hot water usage for baths	55.2469	54.4166	53.2068	50.8920	49.1837	47.2786	46.1958	47.3965	48.7127	50.7581	53.1226	55.0352	(42a)
Hot water usage for other uses	23.8812	23.5265	23.0271	22.1062	21.4166	20.6520	20.2390	20.7350	21.2750	22.0931	23.0330	23.8005	(42b)
Average daily hot water use (litres/day)	33.5813	32.3602	31.1390	29.9179	28.6967	27.4756	27.4756	28.6967	29.9179	31.1390	32.3602	33.5813	(42c)
													103.6058 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	112.7094	110.3033	107.3729	102.9160	99.2971	95.4063	93.9104	96.8282	99.9055	103.9903	108.5158	112.4170	(44)
Energy content (annual)	178.5041	157.0704	165.0281	140.8869	133.6729	117.3131	113.5765	119.8936	123.1935	141.1138	154.6007	176.0178	(45)
Distribution loss (46)m = 0.15 x (45)m													1720.8715
Water storage loss:	26.7756	23.5606	24.7542	21.1330	20.0509	17.5970	17.0365	17.9840	18.4790	21.1671	23.1901	26.4027	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.6007	47.0497	47.8557	49.3426	49.2685	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	229.4630	203.0978	215.9870	190.2020	184.2736	164.3628	161.4323	169.2362	172.4620	192.0727	203.9157	226.9767	(62)
WWHRS	-25.2566	-22.3371	-23.3901	-19.3680	-18.0502	-15.4457	-14.4779	-15.3958	-15.9807	-18.8395	-21.3429	-24.7888	(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	204.2064	180.7607	192.5969	170.8340	166.2234	148.9171	146.9544	153.8404	156.4813	173.2332	182.5728	202.1878	(64)
12Total per year (kWh/year)													2079 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	72.0923	63.7328	67.6116	59.1737	57.0964	50.7690	49.7281	52.2003	53.2790	59.6601	63.7335	71.2656	(65)

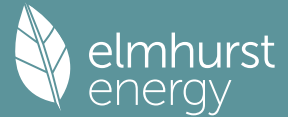
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	81.9454	90.7252	81.9454	84.6769	81.9454	84.6769	81.9454	81.9454	84.6769	81.9454	84.6769	81.9454	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	161.3446	163.0188	158.7997	149.8179	138.4799	127.8237	120.7048	119.0305	123.2496	132.2315	143.5695	154.2256	(68)
Pumps, fans	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	(71)
Total internal gains	96.8983	94.8404	90.8758	82.1856	76.7425	70.5125	66.8389	70.1616	73.9986	80.1883	88.5187	95.7872	(72)
	393.9462	402.3424	385.3789	370.4384	350.9257	333.7711	320.2470	321.8955	332.6830	348.1231	370.5231	385.7161	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	W/m2	Specific data	factor	W
				or Table 6b	Table 6d	
East	3.0200	19.6403	0.6300	0.7000	0.7700	18.1270 (76)

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West				8.0800		19.6403		0.6300		0.7000		0.7700		48.4987 (80)	
Solar gains		66.6258	130.3341	214.6417	313.0421	383.6449	392.7288	373.8938	321.1693	249.6372	154.6524	83.0745	54.7898	(83)	
Total gains		460.5719	532.6765	600.0206	683.4805	734.5706	726.4999	694.1408	643.0648	582.3202	502.7755	453.5975	440.5059	(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	102.4807	102.7413	102.9981	104.2215	104.4536	105.5480	105.5480	105.7532	105.1237	104.4536	103.9851	103.4997				
alpha	7.8320	7.8494	7.8665	7.9481	7.9636	8.0365	8.0365	8.0502	8.0082	7.9636	7.9323	7.9000				
util living area	0.9992	0.9970	0.9870	0.9261	0.7578	0.5392	0.3892	0.4381	0.7137	0.9661	0.9972	0.9994	(86)			
MIT	20.2509	20.3907	20.5972	20.8493	20.9742	20.9984	20.9999	20.9997	20.9876	20.7989	20.4786	20.2301	(87)			
Th 2	19.9677	19.9701	19.9724	19.9832	19.9852	19.9947	19.9947	19.9964	19.9910	19.9852	19.9811	19.9768	(88)			
util rest of house	0.9987	0.9953	0.9798	0.8920	0.6872	0.4556	0.3003	0.3428	0.6184	0.9421	0.9953	0.9991	(89)			
MIT 2	19.1115	19.2916	19.5529	19.8544	19.9700	19.9941	19.9946	19.9964	19.9859	19.8094	19.4132	19.0921	(90)			
Living area fraction	19.6285	19.7904	20.0268	20.3059	20.4257	20.4498	20.4508	20.4516	20.4404	20.2584	19.8966	19.6084	(91)			
MIT	19.6285	19.7904	20.0268	20.3059	20.4257	20.4498	20.4508	20.4516	20.4404	20.2584	19.8966	19.6084	(92)			
Temperature adjustment	19.6285	19.7904	20.0268	20.3059	20.4257	20.4498	20.4508	20.4516	20.4404	20.2584	19.8966	19.6084	(93)			
adjusted MIT	19.6285	19.7904	20.0268	20.3059	20.4257	20.4498	20.4508	20.4516	20.4404	20.2584	19.8966	19.6084	(93)			

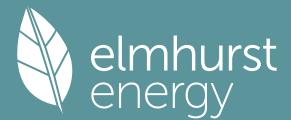
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Utilisation	0.9985	0.9949	0.9803	0.9040	0.7189	0.4936	0.3407	0.3861	0.6621	0.9499	0.9951	0.9989	(94)			
Useful gains	459.8606	529.9750	588.1857	617.8996	528.0741	358.6268	236.4651	248.2740	385.5253	477.5682	451.3612	440.0173	(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	969.5647	939.4620	851.3029	709.3987	541.4952	359.2608	236.4923	248.3459	390.9621	599.3768	797.7071	965.0245	(97)			
Space heating kWh	379.2199	275.1752	195.7592	65.8794	9.9853	0.0000	0.0000	0.0000	0.0000	90.6256	249.3691	390.6054	(98a)			
Space heating requirement - total per year (kWh/year)												1656.6190				
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)			
Solar heating contribution - total per year (kWh/year)												0.0000				
Space heating kWh	379.2199	275.1752	195.7592	65.8794	9.9853	0.0000	0.0000	0.0000	0.0000	90.6256	249.3691	390.6054	(98c)			
Space heating requirement after solar contribution - total per year (kWh/year)												1656.6190				
Space heating per m2										(98c) / (4) =		29.8759	(99)			

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)	
Fraction of space heat from main system(s)												1.0000 (202)	
Efficiency of main space heating system 1 (in %)												92.4000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (207)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	379.2199	275.1752	195.7592	65.8794	9.9853	0.0000	0.0000	0.0000	0.0000	90.6256	249.3691	390.6054	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	410.4111	297.8087	211.8606	71.2980	10.8066	0.0000	0.0000	0.0000	0.0000	98.0797	269.8799	422.7331	(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	204.2064	180.7607	192.5969	170.8340	166.2234	148.9171	146.9544	153.8404	156.4813	173.2332	182.5728	202.1878	(64)
Efficiency of water heater (217)m	85.6879	85.2790	84.4164	82.5217	80.7426	80.3000	80.3000	80.3000	80.3000	83.0597	85.0499	85.7670	(216)
Fuel for water heating, kWh/month	238.3141	211.9639	228.1511	207.0170	205.8682	185.4509	183.0067	191.5820	194.8708	208.5646	214.6654	235.7407	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.0266	13.6594	12.2988	9.0106	6.9601	5.6864	6.3492	8.2529	10.7197	14.0649	15.8862	17.4999	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.0259	-27.7762	-41.3387	-48.1964	-53.4857	-50.5025	-49.9085	-46.3784	-40.3873	-32.5437	-21.2613	-16.3414	(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	-8.0373	-17.1576	-34.5611	-52.5752	-70.1557	-70.6989	-69.8430	-58.8247	-42.7245	-24.7302	-10.7954	-6.3354	(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													1792.8777 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													80.3000
Water heating fuel used													2505.1955 (219)
Space cooling fuel													0.0000 (221)

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Electricity for pumps and fans:	86.0000 (231)
Total electricity for the above, kWh/year	137.4146 (232)
Electricity for lighting (calculated in Appendix L)	

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-913.5851 (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	3607.9027 (238)

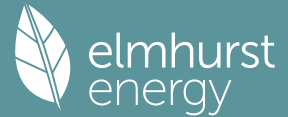
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1792.8777	0.2100	376.5043 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2505.1955	0.2100	526.0911 (264)
Space and water heating			902.5954 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	137.4146	0.1443	19.8332 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-447.1460	0.1338	-59.8443
PV Unit electricity exported	-466.4390	0.1255	-58.5528
Total			-118.3971 (269)
Total CO2, kg/year			815.9607 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.7200 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1792.8777	1.1300	2025.9517 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2505.1955	1.1300	2830.8709 (278)
Space and water heating			4856.8226 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	137.4146	1.5338	210.7712 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-447.1460	1.4946	-668.3012
PV Unit electricity exported	-466.4390	0.4608	-214.9216
Total			-883.2228 (283)
Total Primary energy kWh/year			4314.4718 (286)
Target Primary Energy Rate (TPER)			77.8100 (287)

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Property Reference	Type 2 end East			Issued on Date	15/04/2024
Assessment Reference	Type 2 end East EAHF	Prop Type Ref			
Property					
SAP Rating	84 B	DER	4.05	TER	14.04
Environmental	97 A	% DER < TER			71.15
CO ₂ Emissions (t/year)	0.23	DFEE	33.54	TFEE	36.81
Compliance Check	See BREL	% DFEE < TFEE			8.88
% DPER < TPER	42.27	DPER	42.83	TPER	74.19
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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.4500 (1b)	2.4000 (2b)	133.0800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	133.0800 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												68.8000 (23c)
Effective ac	0.3186	0.3154	0.3122	0.2963	0.2931	0.2771	0.2771	0.2739	0.2835	0.2931	0.2994	0.3058 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			11.1000	1.1450	12.7099		(27)
Door			1.9700	1.2000	2.3640		(26a)
Heatloss Floor 1			55.4500	0.1200	6.6540	110.0000	6099.5000 (28a)
External Wall 1	54.8300	13.0700	41.7600	0.1500	6.2640	110.0000	4593.6000 (29a)
Total net area of external elements Aum(A, m ²)			110.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.9919		(33)
Party Wall 1			17.9900	0.0000	0.0000	110.0000	1978.9000 (32)
Party Ceiling 1			55.4500			30.0000	1663.5000 (32b)
Internal Wall 1			112.6100			75.0000	8445.7500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22781.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							410.8431 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
P1 Party wall - Ground floor				7.5000	0.1200	0.9000	

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E1 Steel lintel with perforated steel base plate	6.5000	0.1500	0.9750
E3 Sill	2.2100	0.0400	0.0884
E4 Jamb	17.3000	0.0500	0.8650
E5 Ground floor (normal)	22.8400	0.0800	1.8272
E7 Party floor between dwellings (in blocks of flats)	22.8400	0.0300	0.6852
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0300	-0.0720
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0000	0.0000
E16 Corner (normal)	7.5000	0.0900	0.6750
E18 Party wall between dwellings	2.4000	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal Bridges (36a) = 5.9438 (36)
 Total fabric heat loss (33) + (36) + (36a) = 33.9357 (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	13.9901	13.8501	13.7102	13.0102	12.8702	12.1703	12.1703	12.0303	12.4503	12.8702	13.1502	13.4302
Heat transfer coeff	47.9258	47.7859	47.6459	46.9460	46.8060	46.1061	46.1061	45.9661	46.3860	46.8060	47.0859	47.3659
Average = Sum(39)m / 12 =												46.9110

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8643	0.8618	0.8593	0.8466	0.8441	0.8315	0.8315	0.8290	0.8365	0.8441	0.8492	0.8542
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8505 (42)
Hot water usage for mixer showers	55.2469	54.4166	53.2068	50.8920	49.1837	47.2786	46.1958	47.3965	48.7127	50.7581	53.1226	55.0352
Hot water usage for baths	23.8812	23.5265	23.0271	22.1062	21.4166	20.6520	20.2390	20.7350	21.2750	22.0931	23.0330	23.8005
Hot water usage for other uses	33.5813	32.3602	31.1390	29.9179	28.6967	27.4756	27.4756	28.6967	29.9179	31.1390	32.3602	33.5813
Average daily hot water use (litres/day)												103.6058 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	178.5041	157.0704	165.0281	140.8869	133.6729	117.3131	113.5765	119.8936	123.1935	141.1138	154.6007	176.0178
Energy content (annual)												1720.8715
Distribution loss (46)m = 0.15 x (45)m	26.7756	23.5606	24.7542	21.1330	20.0509	17.5970	17.0365	17.9840	18.4790	21.1671	23.1901	26.4027
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.8400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.4536 (55)
Total storage loss	14.0616	12.7008	14.0616	13.6080	14.0616	13.6080	14.0616	14.0616	13.6080	14.0616	13.6080	14.0616
If cylinder contains dedicated solar storage	14.0616	12.7008	14.0616	13.6080	14.0616	13.6080	14.0616	14.0616	13.6080	14.0616	13.6080	14.0616
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
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	192.5657	169.7712	179.0897	154.4949	147.7345	130.9211	127.6381	133.9552	136.8015	155.1754	168.2087	190.0794
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	192.5657	169.7712	179.0897	154.4949	147.7345	130.9211	127.6381	133.9552	136.8015	155.1754	168.2087	190.0794
12Total per year (kWh/year)												1886.4355 (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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	59.3526	52.2259	54.8718	46.8449	44.4463	39.0066	37.7642	39.8646	40.9618	46.9203	51.4047	58.5259

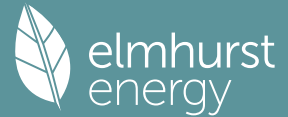
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.3798	90.0991	81.3798	84.0925	81.3798	84.0925	81.3798	81.3798	84.0925	81.3798	84.0925	81.3798
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	161.3446	163.0188	158.7997	149.8179	138.4799	127.8237	120.7048	119.0305	123.2496	132.2315	143.5695	154.2256
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527
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
Losses e.g. evaporation (negative values) (Table 5)	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213
Water heating gains (Table 5)	79.7750	77.7171	73.7525	65.0624	59.7396	54.1759	50.7583	53.5815	56.8914	63.0650	71.3954	78.6639
Total internal gains	373.2573	381.5930	364.6900	349.7307	330.3572	316.8500	303.6009	304.7498	314.9915	327.4342	349.8154	365.0272

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	3.0200	19.6403	0.4300	0.8000	0.7700	14.1399 (76)
West	8.0800	19.6403	0.4300	0.8000	0.7700	37.8312 (80)
Solar gains	51.9711	101.6665	167.4303	244.1871	299.2604	306.3463
Total gains	425.2285	483.2595	532.1203	593.9177	629.6176	623.1963

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7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	132.0399	132.4267	132.8158	134.7960	135.1991	137.2515	137.2515	137.6695	136.4231	135.1991	134.3952	133.6008
alpha	9.8027	9.8284	9.8544	9.9864	10.0133	10.1501	10.1501	10.1780	10.0949	10.0133	9.9597	9.9067
util living area	0.9990	0.9961	0.9814	0.8874	0.6860	0.4734	0.3408	0.3808	0.6258	0.9420	0.9961	0.9994 (86)
Living	20.5016	20.6177	20.7760	20.9455	20.9955	20.9999	21.0000	21.0000	20.9985	20.9139	20.6789	20.4841
Non living	19.6235	19.7730	19.9714	20.1687	20.2127	20.2261	20.2261	20.2283	20.2212	20.1439	19.8606	19.6084
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.1979	20.2001	20.2023	20.2131	20.2153	20.2261	20.2261	20.2283	20.2218	20.2153	20.2109	20.2066 (88)
util rest of house	0.9985	0.9941	0.9723	0.8504	0.6306	0.4162	0.2809	0.3169	0.5564	0.9112	0.9937	0.9990 (89)
MIT 2	20.1979	20.2001	20.2023	20.2131	20.2153	20.2261	20.2261	20.2283	20.2218	20.2153	20.2109	20.2066 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	20.5619	20.5631	20.5642	20.5701	20.5713	20.5773	20.5773	20.5785	20.5749	20.5713	20.5690	20.5666 (92)
Temperature adjustment												0.0000
adjusted MIT	20.5619	20.5631	20.5642	20.5701	20.5713	20.5773	20.5773	20.5785	20.5749	20.5713	20.5690	20.5666 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9988	0.9951	0.9769	0.8681	0.6560	0.4422	0.3081	0.3459	0.5881	0.9266	0.9949	0.9992 (94)
Useful gains	424.7186	480.9149	519.8161	515.5976	413.0203	275.5492	183.3752	192.0645	299.7508	415.1731	412.5143	407.4327 (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	779.3639	748.4724	670.1027	547.8663	415.2314	275.5881	183.3760	192.0671	300.3444	466.7179	634.1988	775.2187 (97)
Space heating kWh	263.8561	179.7986	111.8132	23.2335	1.6450	0.0000	0.0000	0.0000	0.0000	38.3494	159.6128	273.6328 (98a)
Space heating requirement - total per year (kWh/year)												1051.9414
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	263.8561	179.7986	111.8132	23.2335	1.6450	0.0000	0.0000	0.0000	0.0000	38.3494	159.6128	273.6328 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1051.9414
Space heating per m2										(98c) / (4) =		18.9710 (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 %)												303.9499 (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	263.8561	179.7986	111.8132	23.2335	1.6450	0.0000	0.0000	0.0000	0.0000	38.3494	159.6128	273.6328 (98)
Space heating efficiency (main heating system 1)	303.9499	303.9499	303.9499	303.9499	303.9499	0.0000	0.0000	0.0000	0.0000	303.9499	303.9499	303.9499 (210)
Space heating fuel (main heating system)	86.8091	59.1540	36.7867	7.6438	0.5412	0.0000	0.0000	0.0000	0.0000	12.6170	52.5129	90.0256 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	192.5657	169.7712	179.0897	154.4949	147.7345	130.9211	127.6381	133.9552	136.8015	155.1754	168.2087	190.0794 (64)
Efficiency of water heater (217)m	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800	194.1800 (216)
Fuel for water heating, kWh/month	99.1687	87.4298	92.2287	79.5627	76.0812	67.4226	65.7319	68.9850	70.4509	79.9132	86.6251	97.8882 (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	7.7112	6.9650	7.7112	7.4625	7.7112	7.4625	7.7112	7.7112	7.4625	7.7112	7.4625	7.7112 (231)
Lighting	16.9417	13.5913	12.2374	8.9657	6.9253	5.6581	6.3175	8.2118	10.6663	13.9947	15.8070	17.4126 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												346.0903 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												194.1800
Water heating fuel used												971.4880 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)		
mechanical ventilation fans (SFP = 1.0640)	90.7932	(230a)
Total electricity for the above, kWh/year	90.7932	(231)
Electricity for lighting (calculated in Appendix L)	136.7293	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1545.1009	(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	346.0903	0.1581	54.7269 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	971.4880	0.1413	137.2971 (264)
Space and water heating			192.0240 (265)
Pumps, fans and electric keep-hot	90.7932	0.1387	12.5941 (267)
Energy for lighting	136.7293	0.1443	19.7343 (268)
Total CO2, kg/year			224.3524 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0500 (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	346.0903	1.5853	548.6740 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	971.4880	1.5226	1479.1834 (278)
Space and water heating			2027.8574 (279)
Pumps, fans and electric keep-hot	90.7932	1.5128	137.3520 (281)
Energy for lighting	136.7293	1.5338	209.7199 (282)
Total Primary energy kWh/year			2374.9294 (286)
Dwelling Primary energy Rate (DPER)			42.8300 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	55.4500 (1b)	x 2.4000 (2b)	= 133.0800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 133.0800 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1503 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4003	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3402 (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	0.4338	0.4253	0.4168	0.3743	0.3658	0.3232	0.3232	0.3147	0.3402	0.3658	0.3828	0.3998 (22b)
Effective ac	0.5941	0.5904	0.5869	0.5700	0.5669	0.5522	0.5522	0.5495	0.5579	0.5669	0.5733	0.5799 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			1.9700	1.0000	1.9700			(26a)
TER Opening Type (Uw = 1.20)			11.1000	1.1450	12.7099			(27)
Heatloss Floor 1			55.4500	0.1300	7.2085			(28a)
External Wall 1	54.8300	13.0700	41.7600	0.1800	7.5168			(29a)
Total net area of external elements Aum(A, m2)			110.2800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.4052		(33)
Party Wall 1			17.9900	0.0000	0.0000			(32)

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

420.8431 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	7.5000	0.0800	0.6000	
P1 Party wall - Ground floor	6.5000	0.0500	0.3250	
E1 Steel lintel with perforated steel base plate	2.2100	0.0500	0.1105	
E3 Sill	17.3000	0.0500	0.8650	
E4 Jamb	22.8400	0.1600	3.6544	
E5 Ground floor (normal)	22.8400	0.0700	1.5988	
E7 Party floor between dwellings (in blocks of flats)	2.4000	-0.0900	-0.2160	
E17 Corner (inverted - internal area greater than external area)	7.5000	0.0000	0.0000	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.5000	0.0900	0.6750	
E16 Corner (normal)	2.4000	0.0600	0.1440	
E18 Party wall between dwellings				7.7567 (36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				0.0000
Point Thermal bridges				(36a) =
Total fabric heat loss				(33) + (36) + (36a) = 37.1619 (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	26.0905	25.9301	25.7728	25.0340	24.8958	24.2523	24.2523	24.1332	24.5002	24.8958	25.1754	25.4677	(38)
Heat transfer coeff	63.2525	63.0920	62.9347	62.1959	62.0577	61.4143	61.4143	61.2951	61.6621	62.0577	62.3373	62.6297	(39)
Average = Sum(39)m / 12 =												62.1953	
HLP	1.1407	1.1378	1.1350	1.1217	1.1192	1.1076	1.1076	1.1054	1.1120	1.1192	1.1242	1.1295	(40)
HLP (average)												1.1216	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

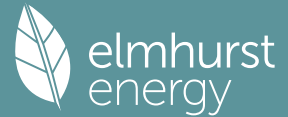
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.8505 (42)
Hot water usage for mixer showers	55.2469	54.4166	53.2068	50.8920	49.1837	47.2786	46.1958	47.3965	48.7127	50.7581	53.1226	55.0352	(42a)
Hot water usage for baths	23.8812	23.5265	23.0271	22.1062	21.4166	20.6520	20.2390	20.7350	21.2750	22.0931	23.0330	23.8005	(42b)
Hot water usage for other uses	33.5813	32.3602	31.1390	29.9179	28.6967	27.4756	27.4756	28.6967	29.9179	31.1390	32.3602	33.5813	(42c)
Average daily hot water use (litres/day)												103.6058	(43)
Daily hot water use	112.7094	110.3033	107.3729	102.9160	99.2971	95.4063	93.9104	96.8282	99.9055	103.9903	108.5158	112.4170	(44)
Energy conte	178.5041	157.0704	165.0281	140.8869	133.6729	117.3131	113.5765	119.8936	123.1935	141.1138	154.6007	176.0178	(45)
Energy content (annual)										Total = Sum(45)m =		1720.8715	
Distribution loss (46)m = 0.15 x (45)m	26.7756	23.5606	24.7542	21.1330	20.0509	17.5970	17.0365	17.9840	18.4790	21.1671	23.1901	26.4027	(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	225.0990	199.1562	211.6230	185.9787	180.2678	162.4050	160.1714	166.4885	168.2854	187.7087	199.6925	222.6127	(62)
WWHRS	-25.2566	-22.3371	-23.3901	-19.3680	-18.0502	-15.4457	-14.4779	-15.3958	-15.9807	-18.8395	-21.3429	-24.7888	(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	199.8424	176.8190	188.2329	166.6108	162.2176	146.9593	145.6935	151.0927	152.3046	168.8692	178.3496	197.8238	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2034.8154	(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	96.6285	85.8945	92.1478	82.9184	81.7222	75.0801	75.0401	77.1405	77.0353	84.1963	87.4782	95.8018	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	92.5266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.9454	90.7252	81.9454	84.6769	81.9454	84.6769	81.9454	81.9454	84.6769	81.9454	84.6769	81.9454	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	161.3446	163.0188	158.7997	149.8179	138.4799	127.8237	120.7048	119.0305	123.2496	132.2315	143.5695	154.2256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	32.2527	(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)	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	-74.0213	(71)
Water heating gains (Table 5)	129.8771	127.8192	123.8545	115.1644	109.8416	104.2779	100.8604	103.6835	106.9935	113.1670	121.4975	128.7659	(72)
Total internal gains	426.9250	435.3212	418.3576	403.4171	384.0248	367.5365	354.2685	355.4174	365.6779	381.1018	403.5018	418.6949	(73)

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					3.0200	19.6403	0.6300	0.7000	0.7700		18.1270 (76)	
West					8.0800	19.6403	0.6300	0.7000	0.7700		48.4987 (80)	
Solar gains	66.6258	130.3341	214.6417	313.0421	383.6449	392.7288	373.8938	321.1693	249.6372	154.6524	83.0745	54.7898 (83)
Total gains	493.5507	565.6553	632.9993	716.4592	767.6697	760.2653	728.1623	676.5867	615.3151	535.7542	486.5763	473.4846 (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	102.4807	102.7413	102.9981	104.2215	104.4536	105.5480	105.5480	105.7532	105.1237	104.4536	103.9851	103.4997	
alpha	7.8320	7.8494	7.8665	7.9481	7.9636	8.0365	8.0365	8.0502	8.0082	7.9636	7.9323	7.9000	
util living area	0.9986	0.9955	0.9821	0.9088	0.7309	0.5157	0.3710	0.4165	0.6799	0.9525	0.9955	0.9990 (86)	
MIT	20.2920	20.4310	20.6342	20.8722	20.9798	20.9988	20.9999	20.9998	20.9911	20.8298	20.5189	20.2713 (87)	
Th 2	19.9677	19.9701	19.9724	19.9832	19.9852	19.9947	19.9947	19.9964	19.9910	19.9852	19.9811	19.9768 (88)	
util rest of house	0.9979	0.9931	0.9725	0.8704	0.6604	0.4355	0.2863	0.3258	0.5868	0.9218	0.9925	0.9984 (89)	
MIT 2	19.1639	19.3425	19.5976	19.8769	19.9736	19.9943	19.9947	19.9964	19.9875	19.8421	19.4641	19.1448 (90)	
Living area fraction									fLA = Living area / (4) =				0.4537 (91)
MIT	19.6758	19.8364	20.0680	20.3285	20.4302	20.4501	20.4508	20.4517	20.4428	20.2902	19.9427	19.6559 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.6758	19.8364	20.0680	20.3285	20.4302	20.4501	20.4508	20.4517	20.4428	20.2902	19.9427	19.6559 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9976	0.9926	0.9736	0.8847	0.6922	0.4720	0.3248	0.3670	0.6294	0.9326	0.9924	0.9982 (94)
Useful gains	492.3494	561.4948	616.2802	633.8485	531.3815	358.8190	236.4743	248.2993	387.2642	499.6338	482.8575	472.6318 (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	972.5560	942.3683	853.8950	710.8088	541.7748	359.2781	236.4933	248.3486	391.1123	601.3542	800.5797	967.9998 (97)
Space heating kWh	357.2737	255.9470	176.7854	55.4114	7.7326	0.0000	0.0000	0.0000	0.0000	75.6799	228.7600	368.5538 (98a)
Space heating requirement - total per year (kWh/year)												1526.1438
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	357.2737	255.9470	176.7854	55.4114	7.7326	0.0000	0.0000	0.0000	0.0000	75.6799	228.7600	368.5538 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1526.1438
Space heating per m2										(98c) / (4) =		27.5229 (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	357.2737	255.9470	176.7854	55.4114	7.7326	0.0000	0.0000	0.0000	0.0000	75.6799	228.7600	368.5538 (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)	387.0788	277.2990	191.5334	60.0340	8.3777	0.0000	0.0000	0.0000	0.0000	81.9934	247.8439	399.2998 (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	199.8424	176.8190	188.2329	166.6108	162.2176	146.9593	145.6935	151.0927	152.3046	168.8692	178.3496	197.8238 (64)
Efficiency of water heater	85.3472	84.8883	83.9193	81.8709	80.1697	79.8000	79.8000	79.8000	79.8000	82.3840	84.6191	79.8000 (216)
Fuel for water heating, kWh/month	234.1523	208.2961	224.3023	203.5042	202.3428	184.1595	182.5734	189.3392	190.8579	204.9782	210.7675	231.5502 (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	17.0266	13.6594	12.2988	9.0106	6.9601	5.6864	6.3492	8.2529	10.7197	14.0649	15.8862	17.4999 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-19.0259	-27.7762	-41.3387	-48.1964	-53.4857	-50.5025	-49.9085	-46.3784	-40.3873	-32.5437	-21.2613	-16.3414 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-8.0373	-17.1576	-34.5611	-52.5752	-70.1557	-70.6989	-69.8430	-58.8247	-42.7245	-24.7302	-10.7954	-6.3354 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												

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(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												1653.4602	(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												2466.8235	(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)												137.4146	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-913.5851	(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												3430.1133	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1653.4602	0.2100	347.2266	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2466.8235	0.2100	518.0329	(264)
Space and water heating			865.2596	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	137.4146	0.1443	19.8332	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-447.1460	0.1338	-59.8443	
PV Unit electricity exported	-466.4390	0.1255	-58.5528	
Total			-118.3971	(269)
Total CO2, kg/year			778.6249	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.0400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1653.4602	1.1300	1868.4100	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2466.8235	1.1300	2787.5106	(278)
Space and water heating			4655.9206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	137.4146	1.5338	210.7712	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-447.1460	1.4946	-668.3012	
PV Unit electricity exported	-466.4390	0.4608	-214.9216	
Total			-883.2228	(283)
Total Primary energy kWh/year			4113.5698	(286)
Target Primary Energy Rate (TPER)			74.1900	(287)

Appendix B – BRUKL Documents

Project name

Huggens College - Be Lean

As designed

Date: Wed Mar 13 11:30:46 2024

Administrative information

Building Details

Address: TBC

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.24

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.24

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

Foundation area [m²]: 543.1The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	6.49
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	6.35
Target primary energy rate (TPER), kWh _{PE} /m ² annum	68.45
Building primary energy rate (BPER), kWh _{PE} /m ² annum	67.52
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	00000000:Surf[3]
Floors	0.18	0.1	0.1	00000000:Surf[11]
Pitched roofs	0.16	0.1	0.1	00000018:Surf[7]
Flat roofs	0.18	0.1	0.1	00000000:Surf[13]
Windows** and roof windows	1.6	1.2	1.2	00000000:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	RM000000:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	4

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 002| PUZ-WM - Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	-	0	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- 001| CAHV-R45YA-HPB - Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	-	0	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- 100| DHW - Instant Electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1.05	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
B1-WC	-	-	0.4	-	-	-	-	-	-	-	-	N/A
B1-WC	-	-	0.4	-	-	-	-	-	-	-	-	N/A
B1-Kitchen	-	-	0.4	-	-	-	-	-	0.4	-	-	N/A
B2-Bath	-	-	0.4	-	-	-	-	-	-	-	-	N/A
B2-Bath	-	-	0.4	-	-	-	-	-	-	-	-	N/A
B2-Bath	-	-	0.4	-	-	-	-	-	-	-	-	N/A
B2-Bath	-	-	0.4	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
B9-Library		100	-	-
B1-Store		100	-	-
B1-Vestry		100	-	-
B1-Plant		100	-	-
B1-WC		100	-	-
B1-Store		100	-	-
B1-Chapel		100	-	-
B1-WC		100	-	-
B1-Circulation		100	-	-
B5-Arts&Crafts		100	-	-
B1-Meeting Room		100	-	-
B1-Chapel		100	-	-
B1-Circulation		100	-	-
B1-Chapel		100	-	-
B2-Laundry		100	-	-
B2-Staff Office		100	-	-
B1-Kitchen		100	-	-
B1-Office		100	-	-
B2-Bed		100	-	-
B2-Bed		100	-	-
B2-Bed		100	-	-
B2-Bath		100	-	-
B2-Bath		100	-	-
B2-Bath		100	-	-
B2-Bath		100	-	-
B2-Bed		100	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B9-Library	NO (-34.3%)	NO
B1-Vestry	NO (-78.9%)	NO
B1-Chapel	NO (-92.2%)	NO
B5-Arts&Crafts	NO (-48.8%)	NO
B1-Meeting Room	YES (+17.4%)	NO
B1-Chapel	NO (-69.1%)	NO
B1-Chapel	N/A	N/A
B2-Staff Office	NO (-76.9%)	NO
B1-Office	NO (-73.2%)	NO
B2-Bed	NO (-77%)	NO
B2-Bed	NO (-79.3%)	NO
B2-Bed	NO (-77.5%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B2-Bed	NO (-77.2%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	543.1	543.1
External area [m ²]	1529.4	1529.4
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	4	3
Average conductance [W/K]	285.75	499.29
Average U-value [W/m ² K]	0.19	0.33
Alpha value* [%]	11.12	10

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

Building Use

% Area Building Type

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

25 Residential Institutions: Hospitals and Care Homes

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

75 Non-residential Institutions: Community/Day Centre

Non-residential Institutions: Libraries, Museums, and Galleries
 Non-residential Institutions: Education
 Non-residential Institutions: Primary Health Care Building
 Non-residential Institutions: Crown and County Courts
 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	13.68	20.69
Cooling	0	0
Auxiliary	4.24	4.36
Lighting	10.8	6.36
Hot water	15.3	14.16
Equipment*	27.48	27.48
TOTAL **	44.02	45.57

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	136.88	207
Primary energy [kWh _{PE} /m ²]	67.52	68.45
Total emissions [kg/m ²]	6.35	6.49

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	144.9	0	14.5	0	3.2	2.78	0	3.09	0
	Notional	211.1	0	21.1	0	2.1	2.78	0	----	----
[ST] Central heating using water: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	128.9	0	12.9	0	5.2	2.78	0	3.09	0
	Notional	202.9	0	20.3	0	3.5	2.78	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Project name

Huggens College

As designed

Date: Wed Mar 13 11:28:44 2024

Administrative information

Building Details

Address: TBC

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.24

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.24

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

Foundation area [m²]: 543.1The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	6.49
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	6.01
Target primary energy rate (TPER), kWh _{PE} /m ² annum	68.45
Building primary energy rate (BPER), kWh _{PE} /m ² annum	63.9
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	00000000:Surf[3]
Floors	0.18	0.1	0.1	00000000:Surf[11]
Pitched roofs	0.16	0.1	0.1	00000018:Surf[7]
Flat roofs	0.18	0.1	0.1	00000000:Surf[13]
Windows** and roof windows	1.6	1.2	1.2	00000000:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	RM000000:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	4

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 002| PUZ-WM - Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	0	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- 001| CAHV-R45YA-HPB - Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.24	-	0	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- 100| DHW - Instant Electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
B1-WC		-	-	0.4	-	-	-	-	-	-	-	N/A
B1-WC		-	-	0.4	-	-	-	-	-	-	-	N/A
B1-Kitchen		-	-	0.4	-	-	-	-	-	0.4	-	N/A
B2-Bath		-	-	0.4	-	-	-	-	-	-	-	N/A
B2-Bath		-	-	0.4	-	-	-	-	-	-	-	N/A
B2-Bath		-	-	0.4	-	-	-	-	-	-	-	N/A
B2-Bath		-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
B9-Library		100	-	-
B1-Store		100	-	-
B1-Vestry		100	-	-
B1-Plant		100	-	-
B1-WC		100	-	-
B1-Store		100	-	-
B1-Chapel		100	-	-
B1-WC		100	-	-
B1-Circulation		100	-	-
B5-Arts&Crafts		100	-	-
B1-Meeting Room		100	-	-
B1-Chapel		100	-	-
B1-Circulation		100	-	-
B1-Chapel		100	-	-
B2-Laundry		100	-	-
B2-Staff Office		100	-	-
B1-Kitchen		100	-	-
B1-Office		100	-	-
B2-Bed		100	-	-
B2-Bed		100	-	-
B2-Bed		100	-	-
B2-Bath		100	-	-
B2-Bath		100	-	-
B2-Bath		100	-	-
B2-Bath		100	-	-
B2-Bed		100	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B9-Library	NO (-34.3%)	NO
B1-Vestry	NO (-78.9%)	NO
B1-Chapel	NO (-92.2%)	NO
B5-Arts&Crafts	NO (-48.8%)	NO
B1-Meeting Room	YES (+17.4%)	NO
B1-Chapel	NO (-69.1%)	NO
B1-Chapel	N/A	N/A
B2-Staff Office	NO (-76.9%)	NO
B1-Office	NO (-73.2%)	NO
B2-Bed	NO (-77%)	NO
B2-Bed	NO (-79.3%)	NO
B2-Bed	NO (-77.5%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B2-Bed	NO (-77.2%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	543.1	543.1
External area [m ²]	1529.4	1529.4
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	4	3
Average conductance [W/K]	285.75	499.29
Average U-value [W/m ² K]	0.19	0.33
Alpha value* [%]	11.12	10

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

Building Use

% Area Building Type

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

25 Residential Institutions: Hospitals and Care Homes

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

75 Non-residential Institutions: Community/Day Centre

Non-residential Institutions: Libraries, Museums, and Galleries
 Non-residential Institutions: Education
 Non-residential Institutions: Primary Health Care Building
 Non-residential Institutions: Crown and County Courts
 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.58	20.69
Cooling	0	0
Auxiliary	4.58	4.36
Lighting	10.8	6.36
Hot water	13.71	14.16
Equipment*	27.48	27.48
TOTAL **	41.68	45.57

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	136.88	207
Primary energy [kWh _{PE} /m ²]	63.9	68.45
Total emissions [kg/m ²]	6.01	6.49

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	144.9	0	13.9	0	3.5	2.89	0	3.24	0
Notional	211.1	0	21.1	0	2.1	2.78	0	----	----
[ST] Central heating using water: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	128.9	0	11.2	0	5.6	3.19	0	3.57	0
Notional	202.9	0	20.3	0	3.5	2.78	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type



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