Brighton & Hove City Council

Portslade Village Centre

Energy Statement

Consult Sustainability

Project Name	Portslade Village Centre
Report Title	Energy Statement
Ref. No.	23.2791-ES
Issue	02
Revision	01
Date	24 November 2023
Prepared by	Hannah Jewkes
Reviewed by	Sam Luker
Approved by	Stuart Searle

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1 Executive Summary

1.1 Purpose

Consult Sustainability has been commissioned by Brighton & Hove City Council (hereby referred to as BHCC) to provide an energy statement for the purpose of demonstrating compliance with planning policy and illustrating the proposed reduction in energy usage and carbon emissions for Portslade Village Centre..

1.2 Introduction

The redevelopment of Portslade Village Centre will deliver 28 new apartments over 2 buildings, to increase needed available housing at an affordable cost.

This report calculates the energy usage and carbon emissions of the proposed development in compliance with the latest Part L 2021 and SAP 10.2 methodology. The project is currently at RIBA Design Stage 3.

The key sustainability aims of the project are to achieve the target KPIs in line with the RIBA 2025 targets. From an energy perspective, this is includes targeting an operational energy use intensity of <60 kWh/m^2/year.

1.3 Approach to the strategy

This Energy Strategy proposes recommendations regarding the approach to reducing carbon dioxide (CO_2) emissions and optimising energy efficiency within the development.

The baseline CO_2 emissions are first established, i.e., the emissions of a scheme that is compliant with the baseline, in line with Part L 2021 guidelines.

The software used to model and calculate the energy performance and carbon emissions for the domestic units was Elmhurst SAP. The Target Emission Rate (TER) for all of the flats were multiplied by floor area to establish the total emissions. The same approach is followed to determine the energy performance and CO_2 emissions of the proposed scheme for each of the steps of the Energy Hierarchy. IES Virtual Environment was used to model and calculate the energy performance and carbon emissions for the non-domestic spaces.

The CO_2 emissions are estimated based on the SAP & IES Dwelling Emission Rates (DER) figures. The Energy Hierarchy aims at delivering significant carbon savings on-site.

The following energy hierarchy has been followed to inform the design, construction, and operation of the proposed development:

- Be lean: use less energy,
- Be clean: supply energy efficiently,
- Be green: use renewable energy,

The implementation of the Energy Hierarchy determines the total regulated carbon savings that can be feasibly and viably achieved on site. As illustrated in table 1 below, the proposed development is anticipated to achieve a 64% reduction in CO_2 emissions over a Part L 2021 baseline.

Table 1: Overall proposed carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	24.3	-	-
Be Lean	20.2	4.1	17%
Be Clean	20.2	0.0	0%
Be Green	8.6	11.6	48%
Total Savings		15.7	64%

2 Introduction

2.1 Location

The Development is located within the jurisdiction of BHCC and will replace the existing Portslade Village Centre building, which is located on Courthope Close, just off Lindfield. An overview of the site is shown in the google image below.

Figure 1: Site Plan (image courtesy of Google Earth)

2.2 Proposed Development

The redevelopment of Portslade Village Centre will deliver 28 new apartments to provide much needed housing in the area, at affordable prices. The Design of Portslade Village Centre can be seen in figures 2 to 5 below.

Figure 2: North Elevation of the proposed West Pavilion Portslade Village Centre Development

Figure 3: South Elevation of the proposed West Pavilion Portslade Village Centre Development

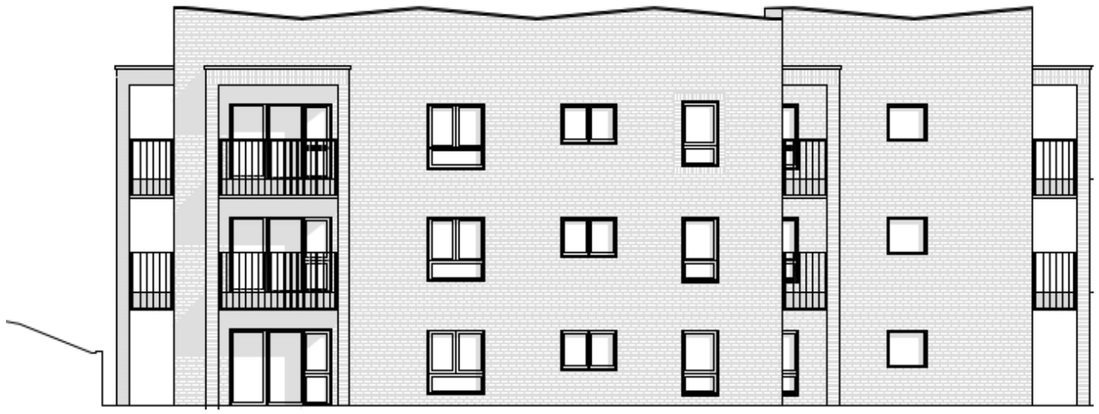

Figure 4: North Elevation of the proposed East Pavilion Portslade Village Centre Development

Figure 5: South Elevation of the proposed East Pavilion Portslade Village Centre Development

3 Planning Policy

The proposal will seek to respond to the energy and carbon policies of the BHCC City Plan (Part One & Two) as well as the 2030 Carbon Neutral Programme. The applicable energy policies in the context of the proposed development are presented below.

3.1 BHCC City Plan Part One

3.1.1 CP8 Sustainable Buildings

1) All development will be required to achieve the minimum standards as set out below unless superseded by national policy or legislation;

Table 2: Energy and Water Performance Requirements of CP8

Residential (New Build)	Fitting Specification
Energy Performance	19% carbon reduction improvement against part L 2013
Water Performance	Water efficiency 'optional' standard

2) All development proposals including conversions, extensions and changes of use will be expected to demonstrate how the development:
    a. addresses climate change mitigation and adaptation;
    b. contributes to a reduction in the city's current level of greenhouse gas emissions by delivering significant reductions in fuel use and greenhouse gas emissions via: passive design and orientation; fabric performance; energy efficiency measures; and low carbon solutions;
    c. facilitates on-site low or zero carbon technologies, in particular renewable energy technologies;
    d. connects, makes contributions to low and zero carbon energy schemes and/or incorporates provision to enable future connection to existing or potential decentralised energy schemes;
    e. aspires towards water neutrality by meeting high water efficiency standards and incorporating facilities to recycle, harvest and conserve water resources;
    f. improves the sustainability of existing buildings, makes the most effective use of land and re-uses existing buildings;
    g. protects occupant health and the wider environment by making the best use of site orientation, building form, layout, landscaping and materials to maximise natural light and heat, whilst avoiding internal overheating by providing passive cooling and ventilation

3.2 BHCC City Plan Part Two

3.2.1 DM44 Energy Efficiency and Renewables

In addition to the requirements set out in Policy CP8 Sustainable Buildings, the following standards of energy efficiency and energy performance will be required unless it can be demonstrated that doing so is not technically feasible and/or would make the scheme unviable:

1) Conversions and change of use of existing buildings to new residential dwellings to achieve at least 19% improvement on the carbon emission targets set by Part L (2013) until the Future Homes Standard or any interim uplift in Part L which exceeds 19% improvement come into effect;
2) A minimum energy Performance Certificate EPC rating 'B' for new build residential and non-residential development.
3) Opportunities for new development to achieve greater reductions in CO_2 emissions through the use of passive design, fabric standards, energy efficiency measures and low and zero carbon technologies will be encouraged in the following areas:
    a. Development Areas 1- 7 (City Plan Part 1);
    b. Housing Allocations in the urban fringe (Policy H2);
    c. Within industrial areas identified and safeguarded in City Plan Part 1 Policy CP3.3.

The following energy hierarchy should inform the design, construction and operation of new buildings:

- Be lean: use less energy
- Be clean: supply energy efficiently,
- Be green: use renewable energy

The priority is to minimise energy demand, and then address how energy will be supplied and renewable technologies incorporated. Fabric and energy efficiency measures are the most effective way to reduce energy demands, CO_2 emissions and costs for occupant of new buildings.

3.2.2 DM45 Community Energy

Developers of medium scale and major development schemes are encouraged to actively seek community energy partners to deliver low and zero carbon energy solutions which are 'led by'; or 'meet the needs' of local communities.

3.2.3 DM46 Heating and cooling network infrastructure

The Council will encourage development proposals to consider the inclusion of integrated heat networks and/or communal heating systems in accordance with Policy CP8 in City Plan Part One.

Where proposals come forward with combined heat and power (CHP) they must meet CHP Quality Assurance standards (CHPQA) and demonstrate that heating and cooling systems have been selected in accordance with the heating and cooling hierarchy, Policy DM40 and have had regard to the CIBSE Heat Network Code of Practice;

All proposals that include heat networks must demonstrate they offer heat service customer protection by adopting a customer protection scheme (such as Heat Trust or equivalent); and

All development incorporating heat network infrastructure which is proposed within or adjacent to a heat priority area will be expected to meet the minimum standards specified in the CIBSE Heat Network Code of Practice and demonstrate its suitability to a future connection to a wider heat network, including;

a. control systems and temperatures of operation;
b. routing of pipework and location of the energy centre;
c. safeguarded access for external pipework into the energy centre; and
d. space within the energy centre for a future heat substation.

4 Be Lean

Passive design and energy efficiency measures are the first step in reducing overall energy demand and carbon emissions for the proposed development. The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space heating, hot water, and lighting. The regulated carbon saving achieved in this step of the Energy Hierarchy is 17% over the baseline.

4.1 Passive design features

4.1.1 Enhanced U-values

The proposed development will incorporate high levels of insulation and high-performance glazing beyond Part L 2021 targets and notional building specifications, in order to reduce the demand for space heating.

The updated passive design and energy efficiency features proposed are detailed below. The parameters below outline the inputs into the calculations at this stage in the design process.

4.1.2 Air Tightness Improvement

The proposed development will aim to improve upon the Part L 2021 minimum standards for air tightness by targeting air permeability rates of $3m^3/m^2$ .h at 50Pa for all areas.

Table 3: Target building fabric thermal parameters

	Domestic
Exposed Floor U-value (W/m2K)	0.10
External Wall U-value (W/m2K)	0.13
Roof U-value (W/m2K)	0.10
Glazing U-value (W/m2K)	1.29 (g-value 0.5)
Air Permeability (m3/h.m2) @ 50Pa	3.0

4.1.3 Thermal Bridging

The proposed development also improves upon the thermal bridging parameters set out within Part L1A 2021 default values, using the accredited Psi (Ψ) values in for some junctions and improved Psi (Ψ) values where deemed feasible. Adjustments to the Ψ values that have been made are outlined in Table 4.

Table 4: Comparison of adjusted psi value for all units

Thermal Bridging Component	Accredited Psi Value	Adjusted Psi Value (All Units)
Jamb (W/mK)	0.05	0.048
Lintel (W/mK)	0.3	0.1
Sill (W/mK)	0.04	0.062
Party floor between dwellings (in blocks of flats) (W/mK)	0.07	0.04

4.1.4 Reducing lighting energy

The development has been designed to maximise daylight in the domestic and non-domestic spaces as a way of improving the health and wellbeing of its occupants.

All of the habitable areas will benefit from generous areas of glazing to increase the amount of daylight within the internal spaces. This is expected to reduce the need for artificial lighting whilst delivering light and healthy spaces for occupants.

4.2 Active design features

4.2.1 High efficiency lighting

The development intends to incorporate low energy lighting fittings throughout the building. All light fittings have been specified as low energy (LED) lighting.

4.2.2 Heat recovery ventilation

Mechanical ventilation heat recovery (MVHR) is proposed for all units. The mechanical ventilation units will include heat recovery in order to achieve ventilation in the most energy-efficient way. Natural ventilation will still be possible via openable windows.

4.2.3 Comfort Cooling

Air source heat pumps with high energy efficiency ratios will be used for both heating and cooling for the non-domestic spaces, therefore the impact of active cooling in terms of energy use and carbon emissions will be minimised.

4.2.4 Controls

Space heating controls will be incorporated to reduce energy associated with heating systems.

Daylight and occupancy sensors will be included within the non-domestic spaces to dim or switch off lights when there is either adequate daylight or a lack of movement. This will further reduce the energy consumption from lighting.

4.2.5 Monitoring

In addition to the above design measures, the development will incorporate smart meters within each unit to enable occupiers to monitor and reduce their energy use.

Table 5: Be Lean stage domestic carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	23.1	-	-
Be Lean	19.1	4.0	17%

Table 6: Be Lean stage non-domestic carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	1.2	-	-
Be Lean	1.1	0.1	2%

Table 7: Be Lean stage overall carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	24.3	-	-
Be Lean	20.2	4.1	17%

5 Be Clean

Given that there was no district heat network proposed or existing within vicinity of the development there were no savings achieved at this stage.

5.1 Energy System Hierarchy

The energy system for the development has been selected in accordance with the decentralised energy hierarchy. The Heating and Cooling hierarchy listed in table 3 of Policy DM46 states that energy systems should follow the below:

Heating and Cooling Hierarchy

System

1. Connection to existing heat/cooling networks
2. Site wide heat/cooling network
3. Building heat/cooling network
4. Individual heating/cooling systems

Technology

1. Systems using renewable/waste energy sources e.g. heat pumps and/or secondary sources
2. Low carbon low emission technologies
3. Conventional systems e.g. gas or direct electric

Figure 6: BHCC Heating and Cooling Hierarchy

5.2 Connection to an existing network

No district heating networks were found that could feasibly be connected to the property.

5.3 Communal heating and cooling

A site-wide centralised ground source heat pump system has been identified as suitable to a development of this size and scale. This is detailed in the subsequent section.

5.4 Be Clean Summary

No connection opportunities to existing district heating networks in the vicinity of the Site have been identified. Opportunities for future connection to any low carbon district heating network (subject to detailed technical, practical, and economic feasibility evaluation) have been considered, however.

Given that it has not been found feasible or viable for the proposed development to incorporate the supply of low carbon heating, no carbon savings have been realised for this step of the Energy Hierarchy.

6 Be Green

The renewable technologies feasibility study carried out for the development identified photovoltaics and ground source heat pumps as suitable technologies for the development. The regulated carbon saving achieved in this step of the Energy Hierarchy is 48% over the site wide baseline level.

6.1 Low and zero carbon (LZC) technology assessment

Renewable or zero carbon technologies harness energy from the environment and convert this to a useful form. Many renewable technologies are available, however, not all of these are commercially viable or suitable for city locations.

6.1.1 Heat Pump Incorporation

Ground source heat pump (GSHPs) use heat exchangers buried in the ground. The efficiency of heat pumps is very much dependent on the temperature difference between the heat source and the space required to be heated. As a result of the relatively stable ground temperature, GSHPs tend to have a higher COP than other methods of heating, including air source heat pumps - ASHPs - due to the varying air temperature. The lower the difference between internal and external air temperature, the more efficient the system.

Suitability to Proposed Development:

Due to grid decarbonisation and the proposed SAP10 carbon factors, it is expected that GSHP technology will offer significant carbon emission reductions over the baseline scenario. The GSHP plant can be located underground and integrated into space heating and hot water systems. Implementing heat-pump technology brings the additional benefit of a shift towards combustion-free development, with the associated benefit to local air quality.

This approach is expected to result in significant regulated CO_2 emission reductions beyond the Building Regulations Part L (2021) 'baseline' on a site-wide basis. GSHPs are therefore proposed for the development as the primary heat generating technology. The Kensa Shoebox S3 units have been assigned with the SAP modelling software.

6.1.2 Photovoltaics

Photovoltaic panels harness energy from sunlight and convert this into useful energy in the form of electricity. A PV system requires viable roof space in order for the system array to be installed and function effectively.

Suitability to Proposed Development:

Solar irradiance analysis on the site has shown a good opportunity for the deployment of solar Photovoltaic technologies for onsite electricity generation. The provision and location of PV panels has been reviewed in detail, with consideration of the following aspects:

- Over shading
- Terraces
- Area required for access
- Area required for plant (ASHP)

An indicative drawing illustrating the installation of the PV panels on the roof can be found in Figure 7 below.

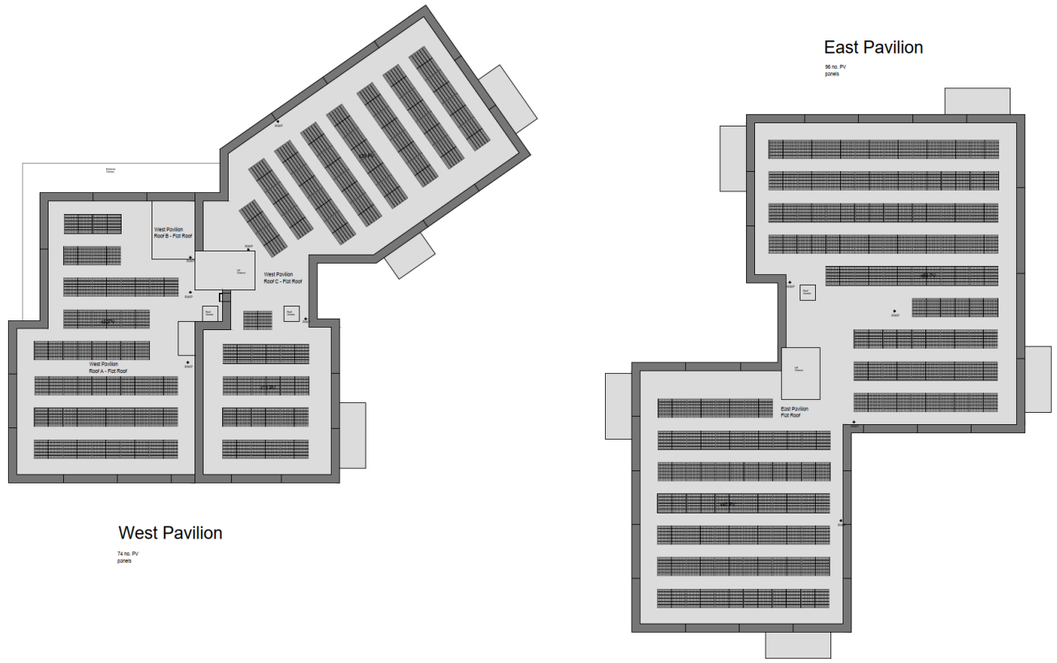

Figure 7: Proposed PV Array on the roof at Portslade Community Centre

Slight amendments will be made to this array, to ensure that there is space for lift overrun, roof access hatch, maintenance routes as well as SVP pop ups. The PV panels will be connected to individual flats via micro-inverters to ensure that the electricity generated is utilised by the tenants. This ensures that carbon savings as well as cost savings are realised by the tenants.

6.2 Be Green Summary

Following the measures adopted at Lean stage, further savings can be obtained through the incorporation of the proposed PV panels and GSHP. Through the integrated performance of the proposed measures at each step in the Energy Hierarchy, the development exceeds the relevant BHCC policies.

At the 'Be Green' stage, the proposed development achieves an estimated saving of 48% (11.6 tonnes per annum) over the baseline scheme.

Table 8: Be Green domestic carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	23.1	-	-
Be Lean	19.1	4.0	17%
Be Clean	19.1	0.0	0%
Be Green	7.5	11.6	48%

Table 9: Be Green non-domestic carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	1.2	-	-
Be Lean	1.1	0.1	2%
Be Clean	1.1	0.0	0%
Be Green	1.1	0.0	2%

Table 10: Be Green overall carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	24.3	-	-
Be Lean	20.2	4.1	17%
Be Clean	20.2	0.0	0%
Be Green	8.6	11.6	48%

7 RIBA Challenge

The RIBA has developed voluntary performance targets for operational energy use, water use and embodied carbon. These performance targets form the basis of the 2030 Climate Challenge which the RIBA has been developed in consultation with other professional UK construction bodies. The performance targets align with the future legislative horizon and set out a challenging but achievable trajectory to realise the significant reductions necessary by 2030 in order to have a realistic prospect of achieving net zero carbon for the whole UK building stock by 2050.

The client and design team have set a voluntary target of achieving the RIBA 2025 target for Operational Energy (EUI **<60 kWh/m² /y**) whilst striving towards the 2030 target (EUI <35 kWh/m^2 /y).

The current Be Green design has been used to calculate the regulated annual energy usage for 3 of the modelled flats, whilst the unregulated energy demand has been taken from Good Homes Alliance's Building Standards Comparison document (21.9 kWh/m^2 /y). As shown in figure 6 below, the proposed Be Green design will enable the achievement of the RIBA Challenge target for operational energy as all 3 modelled flats achieve EUI values lower than 60 kWh/m^2 /y.

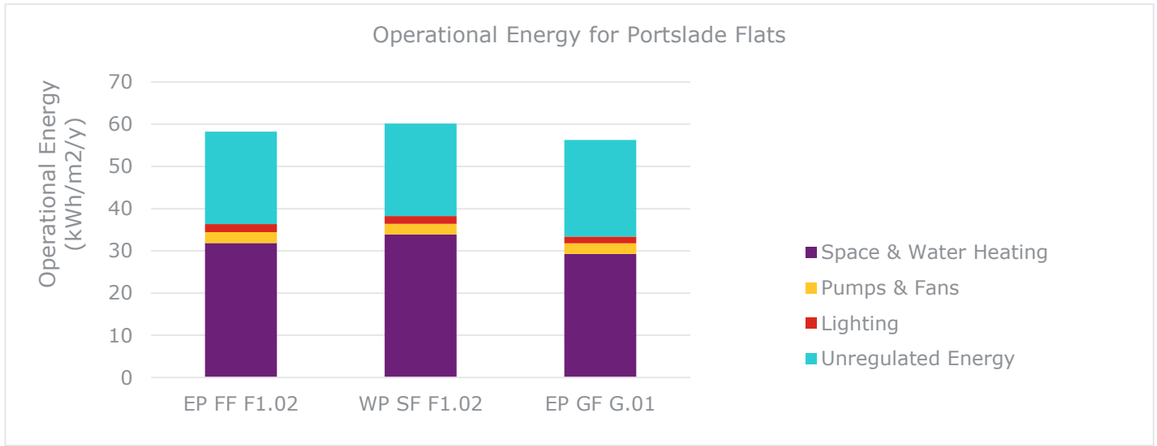

Figure 8: Energy Use Intensity for 3 of the modelled flats

8 Conclusion

Following the implementation of the three-step Energy Hierarchy, the cumulative CO_2 savings on site are estimated at 64% for the development, against a Part L 2021 baseline.

8.1 Carbon Savings

This strategy has shown that the Proposed Development will result in a highly efficient, low-carbon scheme. A high efficiency building fabric coupled with Ground Source Heat Pumps and photovoltaics will reduce the energy consumption and carbon emissions.

Using BHCC's energy hierarchy, the strategy has been developed to ensure that the Proposed Development will be energy efficient and economical. This strategy has been prepared to demonstrate that at the planning stage, the applicant and design team have given due consideration to the principles of energy and sustainability, and how these could be implemented for the Proposed Development.

8.2 Results

The following tables and graphs detail the carbon reductions seen from the baseline case.

Table 11: Domestic proposed carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	23.1	-	-
Be Lean	19.1	4.0	17%
Be Clean	19.1	0.0	0%
Be Green	7.5	11.6	48%
Total Savings		15.6	68%

Table 12: Non-domestic proposed carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	1.2	-	-
Be Lean	1.1	0.1	2%
Be Clean	1.1	0.0	0%
Be Green	1.1	0.0	2%
Total Savings		0.1	2%

Table 13: Overall proposed carbon emissions at the site

	Total Regulated Emissions (Tonnes Co_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage Savings (%)
Part L 2021 Baseline	24.3	-	-
Be Lean	20.2	4.1	17%
Be Clean	20.2	0.0	0%
Be Green	8.6	11.6	48%
Total Savings		15.7	64%

Through the measures outlined in the Energy Strategy, it is anticipated that overall, approximately 64% reduction in CO_2 emissions could be achieved beyond Part L 2021 baseline, inclusive of all measures.

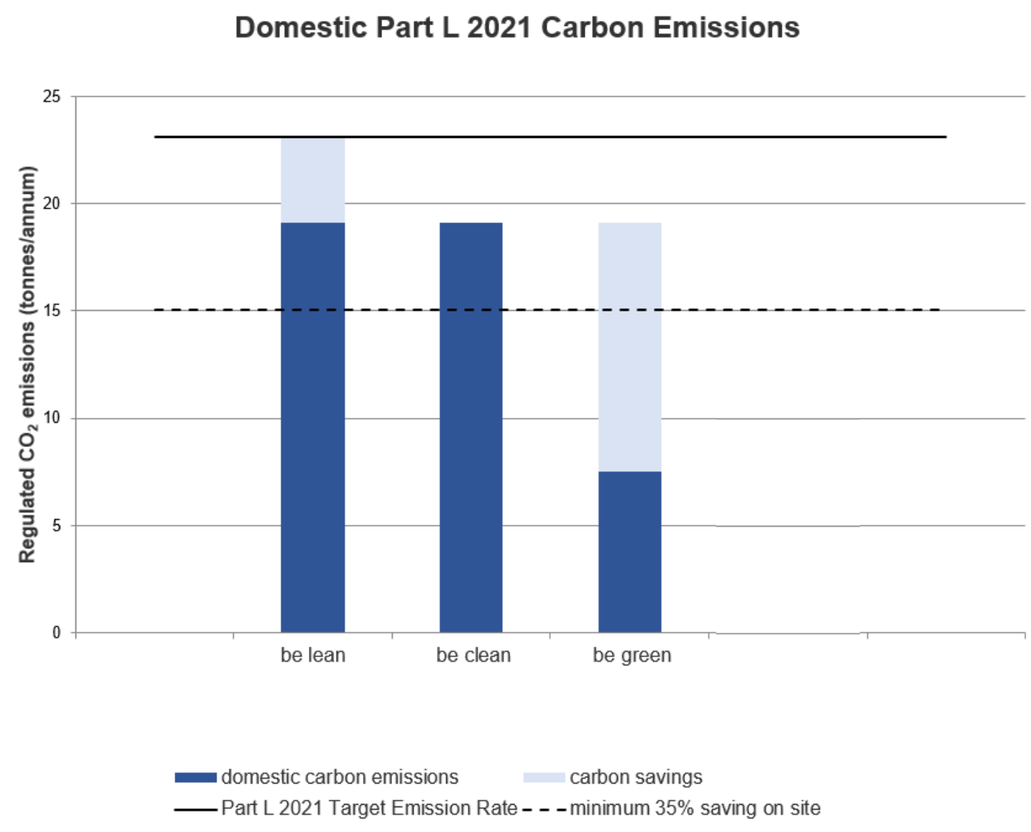

Figure 9: Be green domestic carbon emissions reduction

APPENDIX A

SAP OUTPUTS

Full SAP Calculation Printout

Property Reference	West P F1.02	**Issued on Date**	08/11/2023
Assessment Reference	3a	**Prop Type Ref**	GF1
Property	GF Flat, BN41		

SAP Rating	87 B	**DER**	3.39	**TER**	10.78
Environmental	97 A	**% DER < TER**			68.55
CO_2 Emissions (t/year)	0.22	**DFEE**	23.88	**TFEE**	27.32
Compliance Check	See BREL	**% DFEE < TFEE**			12.58
% DPER < TPER	37.91	**DPER**	35.34	**TPER**	56.92

Assessor Details	Mr. Sam Luker	**Assessor ID**	BC26-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.0000	(1b)	x 2.6500	(2b) =	190.8000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		190.8000	(5)

2. Ventilation rate

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

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

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

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448	(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	
All Windows (Uw = 1.29)			13.4400	1.2267	16.4869			(27)
Door			2.0000	1.2000	2.4000			(26a)
N/EXT	4.8500		4.8500	0.1300	0.6305	9.0000	43.6500	(29a)
W/EXT	22.9200	3.3400	19.5800	0.1300	2.5454	9.0000	176.2200	(29a)
S/EXT	29.2800	10.1000	19.1800	0.1300	2.4934	9.0000	172.6200	(29a)
N/UAS	5.8300	2.0000	3.8300	0.1200	0.4596	9.0000	34.4700	(29a)
Total net area of external elements Aum(A, m2)			62.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.0158			(33)
N/CAS			13.0000	0.0000	0.0000	20.0000	260.0000	(32)
E/CAS			23.0000	0.0000	0.0000	20.0000	460.0000	(32)
Floor to below			72.0000			30.0000	2160.0000	(32d)
Party Ceiling 1			72.0000			20.0000	1440.0000	(32b)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	4746.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		65.9300 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	8.2600	0.0670	0.5534	
E3 Sill	4.4500	0.0620	0.2759	
E4 Jamb	21.6600	0.0480	1.0397	
E7 Party floor between dwellings (in blocks of flats)	42.2400	0.0400	1.6896	
E16 Corner (normal)	7.9500	0.0900	0.7155	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.1200	0.0000	0.0000	
E18 Party wall between dwellings	5.3000	0.0600	0.3180	
E17 Corner (inverted - internal area greater than external area)	2.6500	-0.0900	-0.2385	
E9 Balcony between dwellings, wall insulation continuous	5.6000	0.0200	0.1120	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.4656	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	29.4814	(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	16.2172	16.0165	15.8158	14.8123	14.6116	13.6081	13.6081	13.4074	14.0095	14.6116	15.0130	15.4144	(38)
Heat transfer coeff	45.6985	45.4978	45.2971	44.2937	44.0930	43.0895	43.0895	42.8888	43.4909	44.0930	44.4944	44.8958	(39)
Average = Sum(39)m / 12 =												44.2435	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6347	0.6319	0.6291	0.6152	0.6124	0.5985	0.5985	0.5957	0.6040	0.6124	0.6180	0.6236	(40)
HLP (average)												0.6145	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2937 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	80.4942	79.2845	77.5218	74.1491	71.6602	68.8845	67.3068	69.0562	70.9739	73.9541	77.3992	80.1857	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	38.1196	36.7335	35.3473	33.9611	32.5749	31.1888	31.1888	32.5749	33.9611	35.3473	36.7335	38.1196	(42c)
Average daily hot water use (litres/day)												108.8671	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.6138	116.0179	112.8690	108.1102	104.2351	100.0733	98.4956	101.6312	104.9350	109.3014	114.1326	118.3054	(44)
Energy conte	187.8552	165.2080	173.4755	147.9975	140.3205	123.0518	119.1219	125.8406	129.3953	148.3209	162.6029	185.2376	(45)
Energy content (annual)										Total = Sum(45)m =		1808.4278	
Distribution loss (46)m = 0.15 x (45)m	28.1783	24.7812	26.0213	22.1996	21.0481	18.4578	17.8683	18.8761	19.4093	22.2481	24.3904	27.7856	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6642	(55)
Total storage loss	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902	(56)
If cylinder contains dedicated solar storage	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902	(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	231.7078	204.8168	217.3281	190.4355	184.1731	165.4898	162.9745	169.6932	171.8333	192.1735	205.0409	229.0902	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	231.7078	204.8168	217.3281	190.4355	184.1731	165.4898	162.9745	169.6932	171.8333	192.1735	205.0409	229.0902	(64)
										Total per year (kWh/year) = Sum(64)m =		2324.7568	(64)
12Total per year (kWh/year)												2325	(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	97.5439	86.6187	92.7627	83.1596	81.7386	74.8651	74.6901	76.9241	76.9744	84.3988	88.0159	96.6736	(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	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	103.4480	114.5317	103.4480	106.8963	103.4480	106.8963	103.4480	103.4480	106.8963	103.4480	106.8963	103.4480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9192	204.0145	198.7344	187.4938	173.3045	159.9686	151.0594	148.9641	154.2442	165.4848	179.6741	193.0100	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	(71)
Water heating gains (Table 5)	131.1074	128.8969	124.6810	115.4994	109.8638	103.9793	100.3899	103.3926	106.9088	113.4392	122.2442	129.9376	(72)
Total internal gains	493.8799	504.8484	484.2687	467.2947	444.0216	428.2495	412.3026	413.2100	425.4545	439.7773	466.2199	483.8009	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	10.1000	46.7521	0.5000	0.0000	0.7700	181.7954	(78)
West	3.3400	19.6403	0.5000	0.0000	0.7700	25.2554	(80)

Solar gains	207.0508	347.1390	460.6233	547.3095	592.1021	578.7343	561.7340	529.6260	490.8106	379.7572	246.9801	177.8568	(83)
Total gains	700.9307	851.9873	944.8920	1014.6042	1036.1237	1006.9838	974.0366	942.8360	916.2652	819.5345	713.1999	661.6577	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.8543	28.9816	29.1100	29.7695	29.9050	30.6014	30.6014	30.7446	30.3190	29.9050	29.6352	29.3703	
alpha	2.9236	2.9321	2.9407	2.9846	2.9937	3.0401	3.0401	3.0496	3.0213	2.9937	2.9757	2.9580	
util living area	0.7759	0.6869	0.5996	0.4880	0.3805	0.2700	0.1936	0.2078	0.3199	0.5115	0.6929	0.7940	(86)
Living	20.1394	20.3872	20.5837	20.7548	20.8422	20.8852	20.8953	20.8946	20.8738	20.7600	20.4646	20.1026	
Non living	19.3756	19.6777	19.9158	20.1287	20.2305	20.2892	20.2989	20.3010	20.2729	20.1404	19.7875	19.3393	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.5598	20.3872	20.5837	20.7548	20.8422	20.8852	20.8953	20.8946	20.8738	20.7600	20.4646	20.2281	(87)
Th 2	20.3989	20.4014	20.4039	20.4163	20.4189	20.4314	20.4314	20.4339	20.4264	20.4189	20.4138	20.4088	(88)
util rest of house	0.7629	0.6716	0.5820	0.4684	0.3588	0.2468	0.1689	0.1826	0.2947	0.4883	0.6754	0.7817	(89)
MIT 2	19.9909	19.6777	19.9158	20.1287	20.2305	20.2892	20.2989	20.3010	20.2729	20.1404	19.7875	19.5320	(90)
Living area fraction										fLA = Living area / (4) =		0.3750	(91)
MIT	20.2042	19.9438	20.1662	20.3635	20.4599	20.5127	20.5225	20.5236	20.4982	20.3727	20.0414	19.7931	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2042	19.9438	20.1662	20.3635	20.4599	20.5127	20.5225	20.5236	20.4982	20.3727	20.0414	19.7931	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7585	0.6593	0.5748	0.4666	0.3604	0.2501	0.1728	0.1867	0.2979	0.4864	0.6638	0.7680	(94)
Useful gains	531.6387	561.7556	543.1497	473.4524	373.3697	251.8456	168.3396	175.9829	272.9291	398.6057	473.3882	508.1710	(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	726.8009	684.4602	619.0416	507.7596	386.2490	254.7740	169.0206	176.8566	278.2646	430.9093	575.8178	700.0621	(97)
Space heating kWh	145.2007	82.4575	56.4636	24.7012	9.5821	0.0000	0.0000	0.0000	0.0000	24.0339	73.7493	142.7670	(98a)
Space heating requirement - total per year (kWh/year)												558.9552	
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	145.2007	82.4575	56.4636	24.7012	9.5821	0.0000	0.0000	0.0000	0.0000	24.0339	73.7493	142.7670	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												558.9552	
Space heating per m2											(98c) / (4) =	7.7633	(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 %) 196.8037 (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	145.2007	82.4575	56.4636	24.7012	9.5821	0.0000	0.0000	0.0000	0.0000	24.0339	73.7493	142.7670	(98)
Space heating efficiency (main heating system 1)	196.8037	196.8037	196.8037	196.8037	196.8037	0.0000	0.0000	0.0000	0.0000	196.8037	196.8037	196.8037	(210)
Space heating fuel (main heating system)	73.7794	41.8983	28.6903	12.5512	4.8689	0.0000	0.0000	0.0000	0.0000	12.2121	37.4735	72.5428	(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	231.7078	204.8168	217.3281	190.4355	184.1731	165.4898	162.9745	169.6932	171.8333	192.1735	205.0409	229.0902	(64)
Efficiency of water heater												123.2971	(216)
(217)m	123.2971	123.2971	123.2971	123.2971	123.2971	123.2971	123.2971	123.2971	123.2971	123.2971	123.2971	123.2971	(217)
Fuel for water heating, kWh/month	187.9264	166.1165	176.2638	154.4525	149.3734	134.2203	132.1803	137.6295	139.3653	155.8622	166.2982	185.8034	(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	15.4997	13.9997	15.4997	14.9997	15.4997	14.9997	15.4997	15.4997	14.9997	15.4997	14.9997	15.4997	(231)
Lighting	16.6411	13.3501	12.0203	8.8066	6.8024	5.5576	6.2054	8.0660	10.4770	13.7464	15.5265	17.1036	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-26.8983	-44.4752	-75.4704	-96.0234	-111.3386	-106.2067	-104.2086	-94.3222	-76.2893	-54.7291	-31.2289	-22.2398	(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 1 284.0166 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 123.2971

Water heating fuel used 1885.4918 (219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7840)		
mechanical ventilation fans (SFP = 0.7840)	182.4964	(230a)
Total electricity for the above, kWh/year	182.4964	(231)
Electricity for lighting (calculated in Appendix L)	134.3028	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-843.4307	(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	1642.8769	(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	284.0166	0.1574	44.7007	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1885.4918	0.1410	265.7728	(264)
Space and water heating			310.4735	(265)
Pumps, fans and electric keep-hot	182.4964	0.1387	25.3145	(267)
Energy for lighting	134.3028	0.1443	19.3840	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-843.4307	0.1321	-111.4426	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-111.4426	(269)
Total CO2, kg/year			243.7294	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.3900	(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	284.0166	1.5826	449.4779	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1885.4918	1.5212	2868.2284	(278)
Space and water heating			3317.7063	(279)
Pumps, fans and electric keep-hot	182.4964	1.5128	276.0805	(281)
Energy for lighting	134.3028	1.5338	205.9982	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-843.4307	1.4882	-1255.1925	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1255.1925	(283)
Total Primary energy kWh/year			2544.5924	(286)
Dwelling Primary energy Rate (DPER)			35.3400	(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		72.0000 (1b)	x	2.6500 (2b)	=	190.8000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	190.8000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1572	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4072	(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) =	0.3461	(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													
	0.4413	0.4327	0.4240	0.3808	0.3721	0.3288	0.3288	0.3202	0.3461	0.3721	0.3894	0.4067	(22b)
Effective ac	0.5974	0.5936	0.5899	0.5725	0.5692	0.5541	0.5541	0.5513	0.5599	0.5692	0.5758	0.5827	(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			2.0000	1.0000	2.0000			(26a)
TER Opening Type (Uw = 1.20)			13.4400	1.1450	15.3893			(27)
N/EXT	4.8500		4.8500	0.1800	0.8730			(29a)
W/EXT	22.9200	3.3400	19.5800	0.1800	3.5244			(29a)
S/EXT	29.2800	10.1000	19.1800	0.1800	3.4524			(29a)
N/UAS	5.8300	2.0000	3.8300	0.1800	0.6894			(29a)
Total net area of external elements Aum(A, m2)			62.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.9285			(33)
N/CAS			13.0000	0.0000	0.0000			(32)
E/CAS			23.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 75.9300 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.2600	0.0500	0.4130
E3 Sill	4.4500	0.0500	0.2225
E4 Jamb	21.6600	0.0500	1.0830
E7 Party floor between dwellings (in blocks of flats)	42.2400	0.0700	2.9568
E16 Corner (normal)	7.9500	0.0900	0.7155
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	27.1200	0.0000	0.0000
E18 Party wall between dwellings	5.3000	0.0600	0.3180
E17 Corner (inverted - internal area greater than external area)	2.6500	-0.0900	-0.2385
E9 Balcony between dwellings, wall insulation continuous	5.6000	0.0200	0.1120

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5823 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 31.5108 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6141	37.3759	37.1425	36.0463	35.8412	34.8863	34.8863	34.7095	35.2541	35.8412	36.2561	36.6899	(38)
Heat transfer coeff	69.1249	68.8867	68.6534	67.5571	67.3520	66.3972	66.3972	66.2203	66.7649	67.3520	67.7669	68.2007	(39)
Average = Sum(39)m / 12 =												67.5561	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9601	0.9568	0.9535	0.9383	0.9354	0.9222	0.9222	0.9197	0.9273	0.9354	0.9412	0.9472	(40)
HLP (average)												0.9383	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2937 (42)

Hot water usage for mixer showers

80.4942	79.2845	77.5218	74.1491	71.6602	68.8845	67.3068	69.0562	70.9739	73.9541	77.3992	80.1857	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

38.1196	36.7335	35.3473	33.9611	32.5749	31.1888	31.1888	32.5749	33.9611	35.3473	36.7335	38.1196	(42c)

Average daily hot water use (litres/day) 108.8671 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.6138	116.0179	112.8690	108.1102	104.2351	100.0733	98.4956	101.6312	104.9350	109.3014	114.1326	118.3054	(44)
Energy conte	187.8552	165.2080	173.4755	147.9975	140.3205	123.0518	119.1219	125.8406	129.3953	148.3209	162.6029	185.2376	(45)
Energy content (annual)										Total = Sum(45)m =		1808.4278	

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

28.1783	24.7812	26.0213	22.1996	21.0481	18.4578	17.8683	18.8761	19.4093	22.2481	24.3904	27.7856	(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

234.4501	207.2937	220.0704	193.0893	186.9154	168.1436	165.7168	172.4355	174.4872	194.9158	207.6947	231.8325	(62)
WWHRS -36.7986	-32.5450	-34.0792	-28.2189	-26.2990	-22.5043	-21.0942	-22.4315	-23.2838	-27.4490	-31.0964	-36.1171	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

197.6516	174.7488	185.9912	164.8704	160.6164	145.6394	144.6227	150.0040	151.2034	167.4668	176.5983	195.7154	(64)

Total per year (kWh/year) = Sum(64)m = 2015.1283 (64)

12Total per year (kWh/year) 2015 (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

99.7378	88.6002	94.9565	85.2826	83.9325	76.9882	76.8840	79.1179	79.0974	86.5926	90.1389	98.8674	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	(66)

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

	103.4480	114.5317	103.4480	106.8963	103.4480	106.8963	103.4480	103.4480	106.8963	103.4480	106.8963	103.4480 (67)

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

	201.9192	204.0145	198.7344	187.4938	173.3045	159.9686	151.0594	148.9641	154.2442	165.4848	179.6741	193.0100 (68)

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

	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684 (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)

	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474 (71)

Water heating gains (Table 5)

	134.0562	131.8456	127.6297	118.4481	112.8125	106.9280	103.3387	106.3413	109.8575	116.3879	125.1929	132.8863 (72)

Total internal gains

	499.8286	510.7971	490.2174	473.2434	449.9703	431.1982	415.2513	416.1587	428.4033	445.7260	472.1686	489.7496 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
South	10.1000	46.7521	0.6300	0.7000	0.7700	144.3092	(78)
West	3.3400	19.6403	0.6300	0.7000	0.7700	20.0477	(80)

Solar gains	164.3569	275.5589	365.6427	434.4543	470.0106	459.3993	445.9044	420.4172	389.6055	301.4513	196.0528	141.1827	(83)
Total gains	664.1856	786.3560	855.8602	907.6977	919.9809	890.5975	861.1558	836.5759	818.0087	747.1773	668.2214	630.9323	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.9689	22.0449	22.1198	22.4788	22.5472	22.8715	22.8715	22.9325	22.7455	22.5472	22.4092	22.2666	
alpha	2.4646	2.4697	2.4747	2.4986	2.5031	2.5248	2.5248	2.5288	2.5164	2.5031	2.4939	2.4844	
util living area	0.8725	0.8214	0.7638	0.6759	0.5687	0.4356	0.3243	0.3456	0.4963	0.6911	0.8233	0.8834	(86)
MIT	18.9374	19.3357	19.7702	20.2612	20.6256	20.8649	20.9530	20.9434	20.8008	20.3324	19.5826	18.8768	(87)
Th 2	20.1167	20.1195	20.1222	20.1351	20.1375	20.1487	20.1487	20.1508	20.1444	20.1375	20.1326	20.1275	(88)
util rest of house	0.8602	0.8054	0.7430	0.6479	0.5310	0.3863	0.2660	0.2871	0.4473	0.6588	0.8050	0.8720	(89)
MIT 2	17.7136	18.2058	18.7404	19.3406	19.7660	20.0347	20.1180	20.1123	19.9683	19.4387	18.5299	17.6456	(90)
Living area fraction									fLA = Living area / (4) =			0.3750	(91)
MIT	18.1725	18.6295	19.1266	19.6858	20.0884	20.3460	20.4311	20.4240	20.2805	19.7738	18.9246	18.1073	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1725	18.6295	19.1266	19.6858	20.0884	20.3460	20.4311	20.4240	20.2805	19.7738	18.9246	18.1073	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8273	0.7741	0.7167	0.6323	0.5287	0.3981	0.2857	0.3063	0.4553	0.6440	0.7753	0.8397	(94)
Useful gains	549.4731	608.7115	613.4241	573.8972	486.3994	354.5083	246.0143	256.2265	372.4737	481.1571	518.0559	529.7742	(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	958.9362	945.7821	866.8582	728.6577	564.9725	381.5194	254.3748	266.4677	412.6405	617.8733	801.3187	948.4866	(97)
Space heating kWh	304.6406	226.5115	188.5550	111.4276	58.4584	0.0000	0.0000	0.0000	0.0000	101.7169	203.9492	311.5220	(98a)
Space heating requirement - total per year (kWh/year)												1506.7811	
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	304.6406	226.5115	188.5550	111.4276	58.4584	0.0000	0.0000	0.0000	0.0000	101.7169	203.9492	311.5220	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1506.7811	
Space heating per m2											(98c) / (4) =	20.9275	(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	304.6406	226.5115	188.5550	111.4276	58.4584	0.0000	0.0000	0.0000	0.0000	101.7169	203.9492	311.5220	(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)	330.0548	245.4079	204.2849	120.7233	63.3352	0.0000	0.0000	0.0000	0.0000	110.2024	220.9634	337.5103	(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	197.6516	174.7488	185.9912	164.8704	160.6164	145.6394	144.6227	150.0040	151.2034	167.4668	176.5983	195.7154	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.0266	84.6426	84.0905	83.2007	82.0182	79.8000	79.8000	79.8000	79.8000	82.9779	84.3835	85.0969	(217)
Fuel for water heating, kWh/month	232.4586	206.4547	221.1798	198.1598	195.8302	182.5055	181.2314	187.9749	189.4780	201.8211	209.2805	229.9913	(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	21.4945	17.2437	15.5260	11.3750	8.7864	7.1786	8.0152	10.4185	13.5326	17.7555	20.0548	22.0919	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.2783	-28.5547	-43.0986	-50.9641	-57.1578	-54.1589	-53.4992	-49.4119	-42.5883	-33.7454	-21.6778	-16.5107	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-7.0773	-15.2041	-30.8164	-47.1724	-63.2504	-63.8731	-63.1208	-53.0402	-38.3503	-22.0307	-9.5406	-5.5732	(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	1632.4822	(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	2436.3658	(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)	173.4726	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-889.6951	(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	3438.6255	(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	1632.4822	0.2100	342.8213	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2436.3658	0.2100	511.6368	(264)
Space and water heating			854.4581	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	173.4726	0.1443	25.0375	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-470.6456	0.1336	-62.8592	
PV Unit electricity exported	-419.0495	0.1253	-52.5249	
Total			-115.3842	(269)
Total CO2, kg/year			776.0406	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.7800	(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	1632.4822	1.1300	1844.7049	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2436.3658	1.1300	2753.0934	(278)
Space and water heating			4597.7983	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	173.4726	1.5338	266.0780	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-470.6456	1.4936	-702.9352	
PV Unit electricity exported	-419.0495	0.4601	-192.7915	
Total			-895.7267	(283)
Total Primary energy kWh/year			4098.2504	(286)
Target Primary Energy Rate (TPER)			56.9200	(287)

APPENDIX B

BRUKL REPORT

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Untitled

As built

Date: Tue Oct 17 16:35:41 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.23

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.23

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

Foundation area [m^2]: 391.17

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	2.91	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	2.85	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	31.52	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	30.93	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.13	0.13	MN000000:Surf[1]
Floors	0.18	0.1	0.1	MN000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.59	1.59	MN000000:Surf[3]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
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

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

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

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

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

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

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	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	5	0	-	0.85
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- Main system

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
Main Hall	-	-	-	1	-	-	-	-	-	-	N/A
Office	-	-	-	1	-	-	-	-	-	-	N/A
Hall	-	-	-	1	-	-	-	-	-	-	N/A
Hygiene	-	-	-	1	-	-	-	-	-	-	N/A
Sensory	-	-	-	1	-	-	-	-	-	-	N/A
Meeting	-	-	-	1	-	-	-	-	-	-	N/A
Small Hall	-	-	-	1	-	-	-	-	-	-	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
Main Hall	86	-	-
Office	124	-	-
Store Entrance	85	-	-

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
Hall	64	15	9
Hygiene	107	-	-
Toilets West	161	-	-
Kitchen	258	-	-
Sensory	155	-	-
Meeting	168	-	-
Plant	109	-	-
Store Hall	121	-	-
Toilets East	186	-	-
Small Hall	90	-	-
Small Hall Store	87	-	-

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?
Main Hall	NO (-74.7%)	YES
Office	NO (-67.2%)	YES
Store Entrance	N/A	N/A
Hall	NO (-84.8%)	YES
Hygiene	NO (-98.5%)	YES
Toilets West	N/A	N/A
Kitchen	N/A	N/A
Sensory	NO (-95.1%)	YES
Meeting	NO (-88.2%)	YES
Plant	N/A	N/A
Store Hall	N/A	N/A
Toilets East	N/A	N/A
Small Hall	NO (-69.1%)	YES
Small Hall Store	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	391.2	391.2
External area [m^2]	737.8	737.8
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	181.21	0
Average U-value [W/m^2K]	0.25	0
Alpha value* [%]	25.11	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
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
100	**Non-residential Institutions: Community/Day Centre**
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	4.01	5.03
Cooling	2.18	2.94
Auxiliary	3.37	3.22
Lighting	9.84	7.8
Hot water	0.98	2.29
Equipment*	34.31	34.31
TOTAL**	**20.38**	**21.28**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	85.99	99.33
Primary energy [kWh_{PE}/m^2]	30.93	31.52
Total emissions [kg/m^2]	2.85	2.91

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	56.6	29.4	4	2.2	3.4	3.92	3.74	4	5
	Notional	50.4	49	5	2.9	1.3	2.78	4.63	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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