

ENERGY STRATEGY
BOUNDARY LAKES CLUBHOUSE

BY CMCe & SEES

Date 1/11/23 Rev 1 Planning

Document Control Sheet

Client	LDA.		
Development	Boundary Lakes Clubhouse, Southampton, SO30 3XH		
Report Title:	Energy Strategy		
Author	Rachael Fleming	Reviewed by	Chris Murphy
Date	26.10.2023	Version No.	V 1.0
Reason for version	For Planning		

Revision	Date	Description	Prepared by	Checked by
1.0	26.10.2023	Energy Strategy for PP	Rachael Fleming	Naomi Sadler

About Sadler Energy and Environmental Services Ltd.

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry from the concept and planning stage through to the completion of the project.

Our emphasis is to provide innovative and effective solutions that help built environment businesses design and construct sustainable buildings.

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1. Executive Summary

This energy strategy has been undertaken by Sadler Energy and Environmental Services for the proposed development of Boundary Lakes Clubhouse in Southampton, SO30 3XH, on behalf of CMCE Consulting Engineers (the client), to meet the energy requirements of Policy ESD6: Carbon Dioxide Reduction from the Environmentally Sustainable Development supplementary planning document that supports the Local Plan for Eastleigh Borough Council.

This statement has assessed 'Best Practice', energy efficiency measures and renewable energy solutions for the proposed development. The inclusion of energy efficient measures will minimise on site energy use compared to a building regulation compliant design. These include highly efficient heating and cooling systems, improvements to insulation levels and glazing specification, and energy efficient lighting and appliances.

The feasibility of incorporating low and zero carbon energy sources has also been assessed within this report. SBEM calculations have been carried out for the proposed golf club. The results confirm that an energy strategy with a high standard of fabric efficiency, in conjunction with high efficiency heating and cooling systems will achieve a minimum 15% improvement in carbon emissions over Building Regulations Part L.

2. Information and Background

This Energy Strategy has been produced to identify the measures and technologies necessary to exceed the requirements of Eastleigh Borough Council as well as ensure the building meets the need to reduce reliance on fossil fuels, while reducing carbon emissions arising from new developments, to slow the rate of climate change.

The application site is a golf club with restaurant and bar. The building faces southwest and features a ground floor with a shop, swing studio, storage rooms, foyer, offices, and female and male changing rooms. A stairwell leads from the foyer to the first floor comprising a minimum 128 capacity restaurant, with bars, kitchen, cellar, and storage along with bay doors leading to a terrace overlooking the golfing green. The proposed floor area for the Club is 337.68 m² on the ground floor and 292.54 m² on the first floor.

2.1 Planning targets

The Eastleigh Borough Council Local Plan 2011-2029 was drafted in February 2014 and sets measures to respond to the declared climate emergency. The Environmentally Sustainable Development Supplementary Planning Document outlines the Carbon Dioxide Reduction required from small scale zero/low-carbon technologies to support the Local Plan for Eastleigh Borough Council.

Policy ESD6 states:

The Council requires all new non-residential and multi-residential development (over 1000 sqm of external floorspace) to achieve*:

- at least two BREEAM Ene 5 credits (10% carbon dioxide emissions reductions via local low/zero carbon energy)

- from January 2012 all three BREEAM Ene 5 credits (15% carbon dioxide emissions reductions via local low/zero carbon energy)

A revision from 2015 confirms that: “The ESD SPD still applies in full to non-residential and multi-residential developments where a BREEAM assessment is appropriate and where the total gross internal floor space is at least 500sqm.”

This report will demonstrate compliancy with the Eastleigh Borough Council target of 15% reduction on TER in SBEM calculations.

2.2 Key Policy Targets

- ESD1: A BRE Interim ‘very good’1 (or better) Certificate for the appropriate BREEAM method.
- ESD6; Energy Efficiency CO2 reductions of 15%

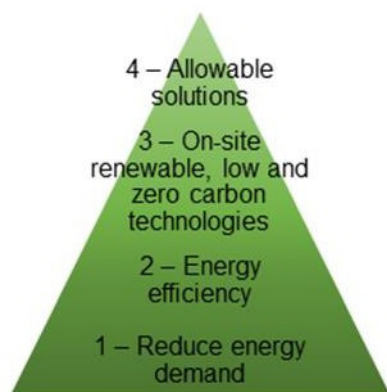
The BREEAM Pre-Assessment has been issued separately to this document.

3. Energy Efficiency – Demand Reduction

SBEM calculations have been carried out for the Golf Club. The results confirm that the energy strategy of a high standard of fabric efficiency, in conjunction with high efficiency heating and cooling systems will achieve the minimum 15% in carbon emissions over Building Regulations 2021 Part L. This is achieved by applying the energy hierarchy detailed below.

3.1 Methodology

This report uses the energy hierarchy to minimise onsite carbon emissions, the stages are:



- ✈ Use Renewable Energy – assess the feasibility of renewable energy systems
- ✈ Supply Energy Efficiently – Use low-carbon technology to significantly reduce energy consumption
- ✈ Use less Energy – the incorporation of low energy design and passive measures to promise the reduction of energy use

3.2 Building Energy Modelling

The site was modelled using Design Builder v.7.1.3.015 SBEM calculations (see appendices), to predict energy demands and CO₂ emissions.

4. Energy Efficiency

A fabric first approach has been adopted to minimise energy demand as much as practical. Energy efficiency features that were proposed include: Built form, Insulation standards, Glazing, Heating systems, Ventilation, Lighting, Controls, Heat recovery, Free cooling, and Equipment.

Three main sources of heat loss:

- Thermal Envelope
- Thermal Bridging
- Uncontrolled Air Leakage

4.1 Thermal Envelope

The table below summarises the proposed performance of the thermal envelope. It is proposed that all areas significantly improve upon the minimum building fabric standards stated within BR Part L 2021.

Thermal Element	BR U-value (Part L 2021) W/m ² K	Proposed target values W/m ² K	% Improvement over BR 2021
Ground Floor	0.18	0.10	44%
Exposed Floor	0.18	0.15	17%
External wall	0.26	0.20	58%
Pitch Roof	0.16	0.10	38%
Flat Roof	0.18	0.10	44%
External Doors	1.6	1.2	25%
Windows & Glazed Doors	1.6	1.2	25%

Table 1 - Proposed Fabric Standard

4.2 Uncontrolled Air Leakage and Ventilation

As buildings become more insulated, uncontrolled air leakage represents an increasing proportion of dwelling heat loss. As such, it is critical to ensure that any unwanted leakage is minimised. Table 2 details the design air permeability at Boundary Lakes. Under current Building Regulations a Non-Domestic building must have an infiltration rate of less than 8m³/hm²@50Pa.

Building	Minimum BR Part L 2021	This building
Air Permeability (m ³ /hm ² 50Pa)	8	5

Table 2 - Air permeability

4.3 Lighting

This model has been simulated with lamps having a luminous efficacy of 95 lumens per circuit watt, this is the minimum requirement under part L 2021.

4.4 Heating

Employing a "fabric first" approach is anticipated to result in reduced space heating demands. All space heating alternatives will rely on electricity, aligning with the ongoing transition away from gas as the predominant energy source for heating and hot water. This adjustment corresponds with the overarching endeavour to decarbonise the National Grid, as detailed in chapter 5, where electricity is set to power both space heating and hot water systems. Three alternative options have been presented for consideration:

1. Option 1: Utilisation of an air source heat pump combined with radiators, featuring local time and temperature control, and providing instantaneous showers.

2. Option 2: Implementation of a Variable Refrigerant Flow (VRF) system, which operates as a heat pump, capable of managing both space heating and cooling, in addition to providing instantaneous showers.
3. Option 3: Adoption of the "Best heating with PV" solution.

Furthermore, a thorough technical assessment is currently in progress to determine the most suitable technology. This evaluation takes into account factors such as noise levels and how occupants use the systems to ensure the installation of the most appropriate technology.

5. Supply Energy Efficiently

In recent years, the electricity grid has undergone de-carbonisation with coal power stations decommissioned and electricity generation moving to cleaner fuel sources and renewable energy such as wind and solar. SAP10 is the first version of SAP which reflects this, with emissions from grid electricity being quarter of what they were previously, which removes the significant benefit that a fossil fuel natural gas heated dwelling used to benefit from. This will encourage a move to

alternative low-carbon heating systems such as heat pumps. This project has been designed with SAP 10.2 Carbon factors.

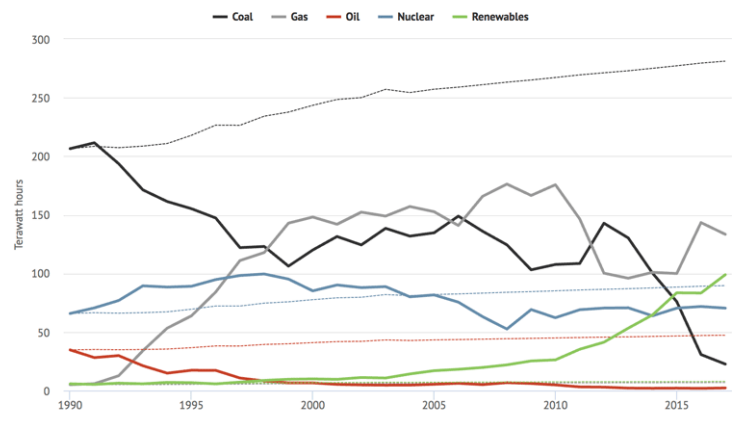


Figure 1 - UK electricity generation by fuel (source: Carbon Brief 2019)

6. Low and Zero Carbon (LZC) Energy Generation and Results

Energy strategy options have been chosen that are capable of meeting and exceeding the requirements of the Eastleigh Borough Council and local planning policy while offering compliancy under Building Regulations 2021 Part L. We have provided three scenarios outlined below.

6.1 Option 1 – Installation of an Air Source Heat Pump System for Space Heating and Hot Water

Within this choice, an air source heat pump system will be employed to supply heat throughout the building. This will be achieved by utilising radiators for heat distribution, complemented by natural ventilation. Additionally, there will be local mechanical extract systems installed in areas such as the kitchen, toilets, and changing rooms.

To enhance energy efficiency, a heat pump with a Coefficient of Performance (COP) rating of 4 will be selected, ensuring effective heating capabilities. Furthermore, the provision of hot water for showers will also be handled by the air source heat pump, making it a comprehensive solution for both space heating and hot water requirements.

6.1.1 Energy Demand and Emissions

The table below shows the percentage reduction in emissions for option 1 compared to the baseline TER. This option results in a 55.75% reduction on Baseline TER.

	Part L 2021 TER Baseline Emissions (tonnes.CO ₂ /year)	Predicted CO ₂ Emissions BER (tonnes.CO ₂ /year)	CO ₂ emission reduction (tonnes.CO ₂ /year)	CO ₂ emissions reduction (%)
Boundary Lakes	36.72	16.25	20.47	55.75

6.2 Option 2 – Variable Refrigerant Flow (VRF) / Variable Refrigerant Volume (VRV)

Option 2 entails the deployment of a Variable Refrigerant Flow (VRF) or Variable Refrigerant Volume (VRV) system, which functions as a versatile heat pump technology. These systems facilitate the operation of multiple indoor units within the same system, enabling both heating and cooling simultaneously.

A VRF/VRV system is a feasible choice for the Proposed Development and can effectively cater to all areas. To maximise the advantages of a VRF/VRV system, smaller spaces within the buildings or areas requiring minimal heating can be equipped with convection heaters. This applies to spaces like communal hallways, toilets, and changing rooms.

The key advantage of VRF/VRV systems lies in their ability to individually regulate the temperature of each space, ensuring a high level of user comfort and offering user-friendly control options. When utilised optimally, a VRF system has the potential to conserve energy by allowing simultaneous heating and cooling in various areas within a building.

Similar to an Air Source Heat Pump (ASHP), the energy efficiency of a VRF/VRV system is assessed using metrics such as the Coefficient of Performance (CoP) and the Energy Efficiency Ratio (EER). It is recommended that a CoP exceeding 4 and an EER greater than 4 be targeted to ensure efficient resource utilisation. For precise sizing and specification, consulting with a specialised installer is advisable to further enhance system performance.

6.2.1 Energy Demand and Emissions – VRF

The tables show the carbon emissions and the percentage reduction in carbon emissions.

	Part L 2021 TER Emissions (tonnes.CO ₂ /year)	Predicted CO ₂ Emissions BER (tonnes.CO ₂ /year)	CO ₂ emission reduction (tonnes.CO ₂ /year)	CO ₂ emissions reduction (%)
Boundary Lakes	36.72	22.55	15.06	40.04

6.3 Option 3 – Integration of Photovoltaic Panels with an Air Source Heat Pump (ASHP)

Option 3 involves the integration of an Air Source Heat Pump (ASHP) with a 4kWp Photovoltaic (PV) solar array, positioned on the south-facing roof of the property. This combination offers the potential to achieve significant benefits.

A 4kW system can be comprised of either 10 panels rated at 400W each or 16 panels rated at 250W each. The specific configuration may depend on the capacity of the individual panels, but it typically requires around 25m² of roof space.

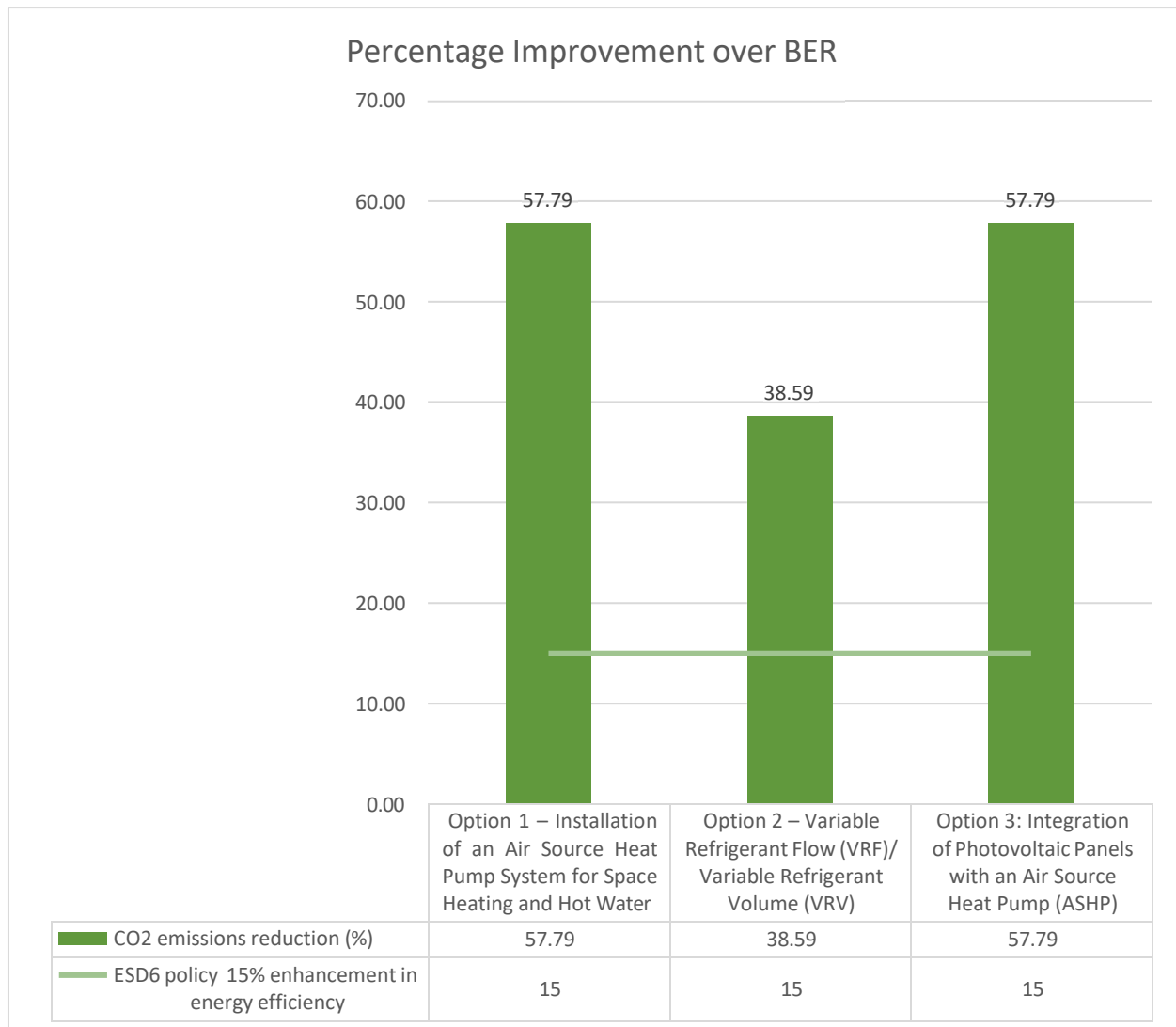
While this approach holds the potential to reduce carbon emissions, it is essential to consider that the overall cost of installation may not be justified by the magnitude of the emissions reduction achieved. Careful cost-benefit analysis is necessary to make an informed decision regarding this option.

6.3.1 Results - Energy Demand and Emissions:

	Part L 2021 TER Emissions (tonnes.CO ₂ /year)	Predicted CO ₂ Emissions BER (tonnes.CO ₂ /year)	CO ₂ emission reduction (tonnes.CO ₂ /year)	CO ₂ emissions reduction (%)
Boundary Lakes	36.72	15.50	21.22	57.79

The outcomes of the Energy Demand and Emissions analysis are illustrated in the graph below. This graph provides a concise summary of the anticipated performance of the simulations in terms of energy efficiency for Options 1, 2, and 3 when compared to the baseline established by Part L 2021 TER.

It is essential to note that the ESD6 policy mandates a 15% enhancement in energy efficiency over the Total Emissions Rate (TER). This benchmark serves as a critical reference point for evaluating the effectiveness of the proposed options in achieving energy efficiency improvements.



Graph 1 – Predicted CO2 emissions rate and % compared to baseline

7. Conclusion

In accordance with the Eastleigh Borough Council Environmentally Sustainable Development Policy, which underscores the imperative of achieving low to zero-carbon emissions in new major developments, along with a minimum 15% reduction in carbon emissions compared to the Total Emissions Rate (TER), our focus has been on incorporating energy-efficient design principles and on-site renewable energy solutions, complemented by emissions offset measures.

After a thorough assessment of the available options for Boundary Lakes, we have reached the following conclusion:

The most favorable option at this stage is Option 2, which entails the implementation of a Variable Refrigerant Flow (VRF) system, accompanied by electric panel heaters in all other conditioned areas, along with a dedicated heat pump for domestic hot water (DHW).

It is essential to note that this option will undergo a more comprehensive examination during the design stage, taking into consideration both technical feasibility and economic viability. At that point, a refined strategy or a combination of strategies will be chosen, ensuring that the development aligns with the council's sustainability objectives and energy efficiency targets.

Appendix A – BRUKL documents

BRUKL Output Document

(i)HMGovernment

Compliance with England Building Regulations Part L 2021

Project name

1819 Boundary Lakes

As designed

Date: Fri Oct 06 23:00:59 2023

Administrative information

Building Details

Address: Botley Road, Southampton, SO30 3XH

Certifier details

Name: Rachael Fleming

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.1.3

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

Foundation area [m2]: 311.74

The CO2 emission and primary energy rates of the building must not exceed the targets

Target CQ emission rate (TEA), kgCO ₂ /m ² annum	36.72
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	16.25
Target primary energy rate (TPER), kWh/m ² :annum	398.28
Building primary energy rate (BPER), kWh/m ² :annum	175.7
Do the building's emission and primary energy rates exceed the targets?	BER=<TERIBPER=<TPER

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

Fabric element	Ua-Umlt	Ua-Calc	U1.ca1c	First surface with maximum value
Walls*	0.26	0.2	0.2	GF Storage 10.07m ² - Zone 1 W7
Floors	0.18	0.12	0.25	FF Cellar - Zone 1_F_3
Pitched roofs	0.16	-	.	No heat loss pitched roofs
Flat roofs	0.18	0.1	0.1	GF Storage 10.07m ² - Zone 1_R_4
Windows** and roof windows	1.6	1.2	1.2	GF Office - Zone 1_G_8
Rooflights***	2.2	-	.	No external rooflights
Personnel doors"	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	.	No external vehicle access doors
High usage entrance doors	3	-	.	No external high usage entrance doors
Ua-Limit= Limiting area-weighted average U-values [W/(m ² K)] Ua-CaJo = Calculated area-weighted average U-values [W/(m ² K)] U1-CaJo= Calculated maximum individual element U-values [W/(m ² K)] • Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. • Display windows and similar glazing are excluded from the U-value check. • Values for rooflights refer to the horizontal position. "For fire doors, limiting U-value is 1.8 W/m ² K NB: Neither roof ventilators (Inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values YES

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

1-ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(1/s)]	HR efficiency
This system	4	-	-	.	.
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					YES
• Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1-ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	5	.
Standard value	2*	N/A
• Standard shown is for all types except absorption and gas engine heat pumps.		

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/(1/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			
GF Storage 10.07m ² - Zone 1	0.2	.	-	-	.	.	.	.	.	.	.	N/A
GF Office - Zone 1	0.2	.	.	.	-	.	.	.	.	.	.	N/A
GF Swing Studio - Zone 1	0.2	-	.	.	.	.	-	-	.	-	.	N/A
GF Pro Shop - Zone 1	0.2	-	.	.	-	-	.	.	.	.	.	N/A
GF Storage 4.25m ² - Zone 1	0.2	.	.	.	-	-	-	.	.	.	.	N/A
GF Female Changing - Changing	0.2	-	-	.	-	-	-	-	.	.	.	N/A
GF Female Changing - Toilet	0.2	.	-	-	-	-	-	.	.	.	.	N/A
GF Entry Female - Zone 1	0.2	-	.	-	-	-	.	.	.	.	.	N/A
GF Foyer - Zone 1	0.2	-	.	-	-	-	-	-	-	-	.	N/A
GF Male toilet - Zone 1	0.2	.	-	-	-	-	-	.	.	.	.	N/A
GF Entry Male - Zone 1	0.2	-	.	-	-	-	.	.	.	.	.	N/A
GF Men Changing - Zone 1	0.2	-	.	-	-	-	-	-	-	-	.	N/A
FF Cellar - Zone 1	0.2	.	-	-	-	-	-	.	.	.	.	N/A

Zone name	SFP [W/(1/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
FF Service Corridor - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Storage 12.27 - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Kitchen - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Restaurant and Bar - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA

"LENI calculation for lighting energy provided in a separate submission."

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?
GF Office - Zone 1	NO (-5.8%)	YES
GF Swing Studio - Zone 1	YES (+22.2%)	YES
GF Pro Shop - Zone 1	YES (+3.8%)	YES
GF Foyer - Zone 1	YES (+107.4%)	YES
FF Restaurant and Bar - Zone 1	NO (-14.9%)	YES

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?	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]	623.5	623.5
External area [m ²]	1500.2	1500.2
Weather	SOU	SOU
Infiltration [m ³ /hrn ² @ 50Pa]	5	3
Average conductance [WIK]	343.84	422.34
Average U-value [W/m ² K]	0.23	0.28
Alpha value* [%]	32.9	25.77

* Percenta ge of the bulding's avera ga heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	Retail/Financial and Professional Services
	Restaurants and CafeS/Drinking EstabllshmentS/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Tenninals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others:CarParks24hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	15.74	24.19
Cooling	0	0
Auxiliary	12.7	15.34
Lighting	21.73	16.99
Hot water	65.47	212.73
Equipment*	56.8	56.8
TOTAL**	115.63	269.25

* 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, 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
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating+ cooling demand [MJ/m ²]	421.17	385.9
Primary energy [kWh/m ²]	175.7	398.28
Total emissions (kg/m ²)	16.25	36.72

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: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Natural Gas									
Actual	212.8	208.3	15.7	0	12.7	3.76	0	4	0
Notional	229.9	156	24.2	0	13.6	2.64	0		

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
HeatSSEFF	= 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

BRUKL Output Document

(i)HMGovernment

Compliance with England Building Regulations Part L 2021

Project name

1819 Boundary Lakes

As designed

Date: Fri Oct 06 23:10:29 2023

Administrative information

Building Details

Address: Botley Road, Southampton, SO30 3XH

Certifier details

Name: Rachael Fleming

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.1.3

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

Foundation area [m2]: 311.74

The CO2 emission and primary energy rates of the building must not exceed the targets

Target CQ emission rate (TEA), kgCO ₂ /m ² annum	37.61
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	22.55
Target primary energy rate (TPER), kWh/m ² :annum	410.01
Building primary energy rate (BPER), kWh/m ² :annum	246.37
Do the building's emission and primary energy rates exceed the targets?	BER=<TERIBPER=<TPER

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

Fabric element	Ua-Umlt	Ua-Calc	U1-ca1c	First surface with maximum value
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Rooflights***	2.2	-	.	No external rooflights
Personnel doors"	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	.	No external vehicle access doors
High usage entrance doors	3	-	.	No external high usage entrance doors
Ua-Limit= Limiting area-weighted average U-values [W/(m ² K)] Ua-CaJo = Calculated area-weighted average U-values [W/(m ² K)] U1-ca1c = Calculated maximum individual element U-values [W/(m ² K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. "For fire doors, limiting U-value is 1.8 W/m ² K NB: Neither roof ventilators (Inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values YES

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

1-VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.35	4	-	3	-
Standard value	2.5*	5	N/A	2A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system INO					
• Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
" Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1-ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	5	-
Standard value	2*	N/A
• Standard shown is for all types except absorption and gas engine heat pumps.		

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			
GF Storage 10.07m ² - Zone 1	0.2	.	.	.	-	.	.	.	.	.	.	N/A
GF Office - Zone 1	0.2	-	.	.	-	-	-	-	-	.	.	N/A
GF Swing Studio - Zone 1	0.2	.	.	.	-	-	-	-	.	.	.	N/A
GF Pro Shop - Zone 1	0.2	.	.	.	-	-	-	-	-	.	.	N/A
GF Storage 4.25m ² - Zone 1	0.2	-	.	.	-	-	-	-	-	.	.	N/A
GF Female Changing - Changing	0.2	.	.	-	-	-	-	-	-	-	-	N/A
GF Female Changing - Toilet	0.2	.	.	.	-	-	-	-	.	-	-	N/A
GF Entry Female - Zone 1	0.2	-	.	-	-	-	-	-	-	-	-	N/A
GF Foyer - Zone 1	0.2	.	.	-	-	-	-	-	-	-	-	N/A
GF Male toilet - Zone 1	0.2	.	.	.	-	-	-	-	.	-	-	N/A
GF Entry Male - Zone 1	0.2	-	.	-	-	-	-	-	-	-	-	N/A
GF Men Changing - Zone 1	0.2	.	.	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(1/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
FF Cellar - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Service Corridor - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Storage 12.27 - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Kitchen - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Restaurant and Bar - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	N/A

"LENI calculation for lighting energy provided in a separate submission."

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?
GF Storage 10.07m2 - Zone 1	N/A	N/A
GF Office - Zone 1	NO (-5.8%)	YES
GF Swing Studio - Zone 1	YES (+22.2%)	YES
GF Pro Shop - Zone 1	YES (+3.8%)	YES
GF Storage 4.25m2 - Zone 1	N/A	N/A
GF Female Changing - Changing	N/A	N/A
GF Female Changing - Toilet	N/A	N/A
GF Entry Female - Zone 1	YES (+87.6%)	YES
GF Foyer - Zone 1	YES (+107.4%)	YES
GF Male toilet - Zone 1	N/A	N/A
GF Entry Male - Zone 1	YES (+97.7%)	YES
GF Men Changing - Zone 1	N/A	N/A
FF Cellar - Zone 1	N/A	N/A
FF Service Corridor - Zone 1	YES (+0.9%)	YES
FF Storage 12.27 - Zone 1	N/A	N/A
FF Kitchen - Zone 1	N/A	N/A
FF Restaurant and Bar - Zone 1	NO (-14.9%)	YES

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?	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]	623.5	623.5
External area [m ²]	1500.2	1500.2
Weather	SOU	SOU
Infiltration [m ³ /hrn ² @ 50Pa]	5	3
Average conductance [WIK]	343.84	422.34
Average U-value [W/m ² K]	0.23	0.28
Alpha value* [%]	32.9	25.77

* Percenta ge of the bulding's avera ga heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	Retail/Financial and Professional Services
	Restaurants and CafeS/Drinking EstabllshmentS/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Tenninals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others:CarParks24hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	14.32	6.48
Cooling	24.03	10.42
Auxiliary	37.45	31.28
Lighting	21.73	16.99
Hot water	65.47	212.73
Equipment*	56.8	56.8
TOTAL**	163	277.92

* 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, 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
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating+ cooling demand [MJ/m ²]	429.13	226.75
Primary energy [kWh/m ²]	246.37	410.01
Total emissions (kg/m ²)	22.55	37.61

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] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	220.8	208.3	14.3	24	37.5	4.28	2.41	4.35	4
Notional	61.6	165.1	6.5	10.4	29.6	2.64	4.4		

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
HeatSSEFF	= 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

BRUKL Output Document

(i)HMGovernment

Compliance with England Building Regulations Part L 2021

Project name

1819 Boundary Lakes

As designed

Date: Fri Oct 06 23:29:11 2023

Administrative information

Building Details

Address: Botley Road, Southampton, SO30 3XH

Certifier details

Name: Rachael Fleming

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.1.3

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

Foundation area [m2]: 311.74

The CO2 emission and primary energy rates of the building must not exceed the targets

Target CQ emission rate (TEA), kgCO ₂ /m ² annum	36.72
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	15.15
Target primary energy rate (TPER), kWh/m ² :annum	398.28
Building primary energy rate (BPER), kWh/m ² :annum	163.33
Do the building's emission and primary energy rates exceed the targets?	BER=<TERIBPER=<TPER

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

Fabric element	Ua-Umlt	Ua-Calc	U1-ca1c	First surface with maximum value
Walls*	0.26	0.2	0.2	GF Storage 10.07m ² - Zone 1 W7
Floors	0.18	0.12	0.25	FF Cellar - Zone 1_F_3
Pitched roofs	0.16	-	.	No heat loss pitched roofs
Flat roofs	0.18	0.1	0.1	GF Storage 10.07m ² - Zone 1_R_4
Windows** and roof windows	1.6	1.2	1.2	GF Office - Zone 1_G_8
Rooflights***	2.2	-	.	No external rooflights
Personnel doors"	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	.	No external vehicle access doors
High usage entrance doors	3	-	.	No external high usage entrance doors
Ua-Limit= Limiting area-weighted average U-values [W/(m ² K)] Ua-CaJo = Calculated area-weighted average U-values [W/(m ² K)] U1-ca1c = Calculated maximum individual element U-values [W/(m ² K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. "For fire doors, limiting U-value is 1.8 W/m ² K NB: Neither roof ventilators (Inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values YES

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

1-ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(1/s)]	HR efficiency
This system	4	-	-	.	.
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					YES
• Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1-ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	5	.
Standard value	2*	N/A
• Standard shown is for all types except absorption and gas engine heat pumps.		

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/(1/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			
GF Storage 10.07m ² - Zone 1	0.2	.	-	-	.	.	.	.	.	.	.	N/A
GF Office - Zone 1	0.2	.	.	.	-	.	.	.	.	.	.	N/A
GF Swing Studio - Zone 1	0.2	-	.	.	.	.	-	-	.	-	.	N/A
GF Pro Shop - Zone 1	0.2	-	.	.	-	-	.	.	.	.	.	N/A
GF Storage 4.25m ² - Zone 1	0.2	.	.	.	-	-	-	.	.	.	.	N/A
GF Female Changing - Changing	0.2	-	-	.	-	-	-	-	.	.	.	N/A
GF Female Changing - Toilet	0.2	.	-	-	-	-	-	.	.	.	.	N/A
GF Entry Female - Zone 1	0.2	-	.	-	-	-	.	.	.	.	.	N/A
GF Foyer - Zone 1	0.2	-	.	-	-	-	-	-	-	-	.	N/A
GF Male toilet - Zone 1	0.2	.	-	-	-	-	-	.	.	.	.	N/A
GF Entry Male - Zone 1	0.2	-	.	-	-	-	.	.	.	.	.	N/A
GF Men Changing - Zone 1	0.2	-	.	-	-	-	-	-	-	-	.	N/A
FF Cellar - Zone 1	0.2	.	-	-	-	-	-	.	.	.	.	N/A

Zone name	SFP [W/(1/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
FF Service Corridor - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Storage 12.27 - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Kitchen - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA
FF Restaurant and Bar - Zone 1	0.2	.	.	.	.	.	.	.	.	.	.	NIA

"LENI calculation for lighting energy provided in a separate submission."

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?
GF Office - Zone 1	NO (-5.8%)	YES
GF Swing Studio - Zone 1	YES (+22.2%)	YES
GF Pro Shop - Zone 1	YES (+3.8%)	YES
GF Foyer - Zone 1	YES (+107.4%)	YES
FF Restaurant and Bar - Zone 1	NO (-14.9%)	YES

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?	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]	623.5	623.5
External area [m ²]	1500.2	1500.2
Weather	SOU	SOU
Infiltration [m ³ /hrn ² @ 50Pa]	5	3
Average conductance [WIK]	343.84	422.34
Average U-value [W/m ² K]	0.23	0.28
Alpha value* [%]	32.9	25.77

* Percenta ge of the bulding's avera ga heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	Retail/Financial and Professional Services
	Restaurants and CafeS/Drinking EstabllshmentS/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Tenninals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others:CarParks24hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	15.81	24.19
Cooling	0	0
Auxiliary	9.37	15.34
Lighting	21.73	16.99
Hot water	65.47	212.73
Equipment*	56.8	56.8
TOTAL**	112.37	269.25

* 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, applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	5.08	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	5.08	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating+ cooling demand [MJ/m ²]	422.1	385.9
Primary energy [kWh/m ²]	163.33	398.28
Total emissions (kg/m ²)	15.15	36.72

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: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Natural Gas									
Actual	213.8	208.3	15.8	0	9.4	3.76	0	4	0
Notional	229.9	156	24.2	0	13.6	2.64	0		

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
HeatSSEFF	= 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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